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ABSTRACT

An analysis of tone in language begins with the observation that the structural approach taken in segmental phonology, analyzing complex tones in terms of sequences of level tones, is not necessarily appropriate with tone languages. A different approach is proposed, a "dynamic-tone" theory that represents tone contours entirely in terms of two "tone markers" representing rising and falling pitch. This theory is offered as a universal theory of tone. The first three chapters outline the way in which the theory accounts for a wide variety of tonal phenomena, including pitch-accent language, tone languages, and phrasal tone. The fourth chapter, concerned with the nature of and constraints on tone rules, describes how tone rules may be confined to three processes: insertion, movement, and deletion of a tone marker. Chapter 5 addresses a number of issues, including tonal stability and the theory of gliding tones. The sixth and seventh chapters contain detailed analysis of the tonal system of Igbo, with particular attention to the specification of syntactic environments for its major tonal processes. In chapter 8, the interaction between phonology and syntax is examined, and a specific constraint is proposed. (Contains 68 references.) (MSE)

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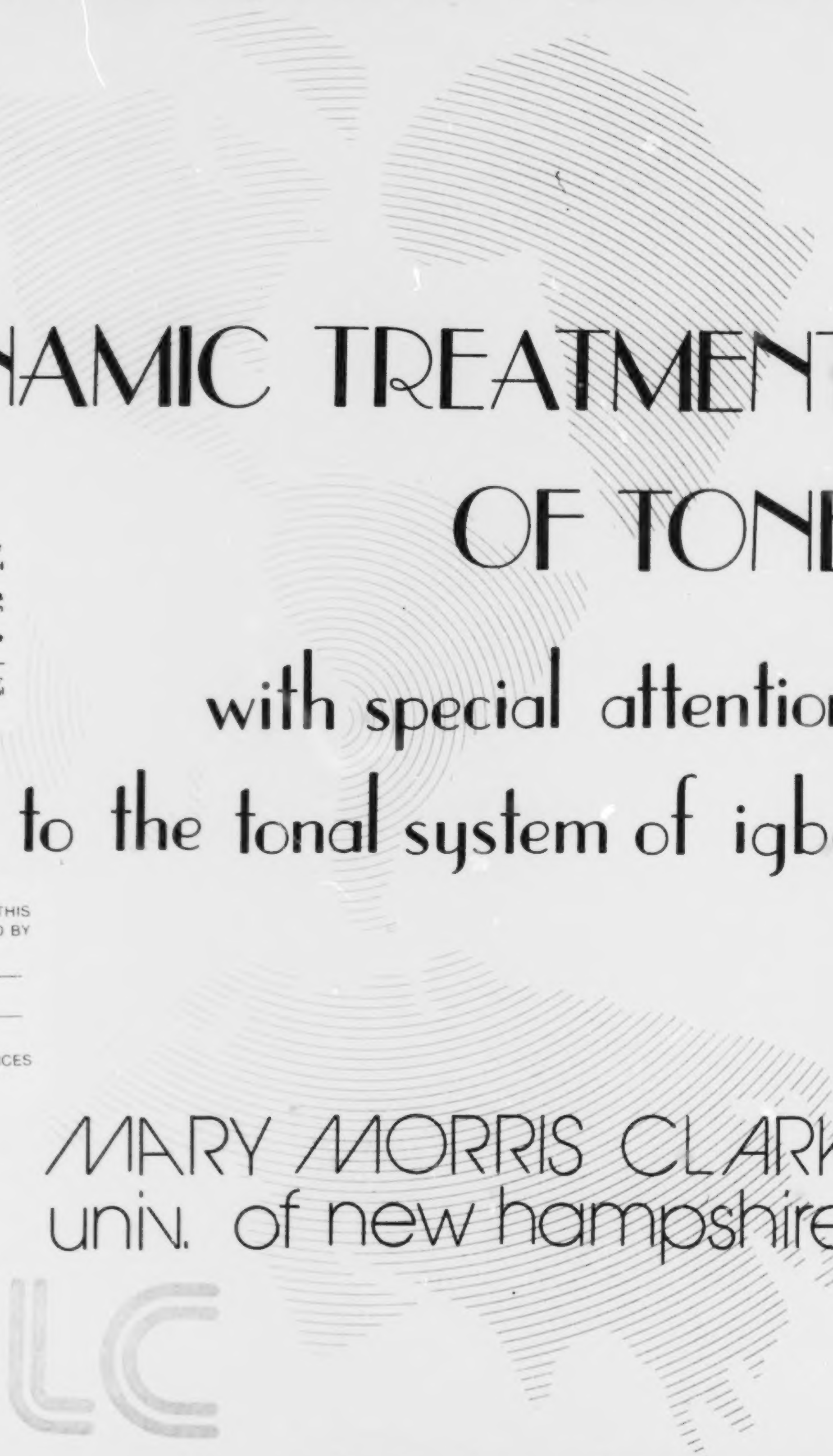

A DYNAMIC TREATMENT OF TONE

with special attention to the tonal system of igbo

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A DYNAMIC TREATMENT OF TONE
WITH SPECIAL ATTENTION TO THE TONAL SYSTEM OF IGBO

By

Mary Morris Clark

University of New Hampshire

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This dissertation is dedicated to

my husband, Raymond

and my children, Susannah, Johathan, and Kathryn,

who loved me enough to let me write it.

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First of all, I would like to express my deep gratitude to my advisors, Lisa Selkirk and Alan Prince, for the many hours they spent with me during the writing and re-writing of this dissertation. Their thoughtful and constructive questioning of every argument and every analysis has made this a far deeper and more comprehensive piece of work than it would have been without their help. In addition, specific suggestions of theirs underlie many of the analyses which are proposed here.

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Although many people have contributed to the development of this dissertation, I must myself take responsibility for the errors, misconceptions, inconsistencies, and flaws in reasoning which will undoubtedly be found here.

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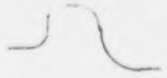
INTRODUCTION

There are two ways of looking at the tone contour of a sentence like



It's raining.

On the one hand, this tone contour could be described as a sequence of level tones; that is, we could say that the syllable *its* is pronounced on a mid tone level, the syllable *rain* on a high tone level, and the syllable *ing* on a low tone level. When the tone contour diagram is looked at in this way, its vertical lines, which appear at points of pitch change, appear to be automatic and redundant; the rise in pitch between the syllables *its* and *rain* is simply a transition between the mid tone level of the first syllable and the high tone level of the second, and similarly, the drop in pitch between *rain* and *ing* is a transition between the high and low tone levels of these two syllables. I will call a theory which defines a tone contour in this way, as a sequence of level tones, a *level-tone theory*.

Alternatively, the tone contour above could be described in terms of its transition points: that is, we might say that there is a rise in pitch between the two syllables *its* and *rain* and a (larger) fall in pitch between the two syllables *rain* and *ing*. Now it is the level spaces between the pitch changes which are automatic and redundant; *its* is pronounced on a lower tone level than *rain* because there is a rise in pitch between them, and in turn, the difference in pitch level between *rain* and *ing* results from the fact that there is a drop in pitch between them.

In studying the pitch contours which arise in human languages, linguists have generally described them primarily in level-tone terms. There are a few exceptions: the Japanese linguist Hattori makes use of "accent-corners" to mark points of pitch change, and some British linguists including David Crystal have described English intonation primarily in dynamic terms.[1] However, this is the exception rather than the rule, and I do not know of any linguist who has applied this kind of system to tone languages. There are, of course, many linguists who have used a sort of mixed system; for example, the tones of Mandarin are generally said to be high level, rising, falling, and falling-rising. However, the terms "rising" and "falling" are used in this context to refer to what happens on a single syllable and not to what happens over a sequence of two or more syllables; moreover, there has been a tendency recently to analyze "complex" tones such as the rising and falling tones of Mandarin as sequences of level tones associated with a single syllable.

It is not surprising that linguists tend to approach tone in level-tone terms, for this is the approach which has been so fruitful in segmental phonology. No one would think of describing the vowel sequence [ai] by specifying the transition which must be made to get from [a] to [i]; rather we describe the first end-point configuration, [a], and then the second end-point configuration [i] and assume that what happens between them is automatic and of no theoretical consequence. But while this approach is surely right for most aspects of segmental phonology, it is not so surely right for tone, where there are no reliable end-point configurations of the kind which segmental phonemes represent. Any pitch level above the absolute bottom of the pitch range of the voice may count as a high tone on some occasion, and any pitch level below the top of the range may count as low. In the Igbo sentence

> Ọ́ nà áw̃à ị́gbā ígwè áh̄ù
>
> he is trying to ride bicyle that
>
> 'He is trying to ride that bicycle.'
>
> (Where ´ = high tone, ` = low tone, and ¯ = downstepped high)

the "high" tone on the first syllable of áh̄ù 'that' will almost certainly be lower in pitch than the "low" tone on the progressive marker nà earlier in the sentence. (This example is taken from Hyman (1975).) One does not find this degree of relativity in segmental phonology. There are no contexts in which [a] is higher that [i], or [i] further back than [a].

The facts above do not constitute evidence AGAINST a theory of tone which views tone contours as sequences of end-point configurations such as "high tone" and "low tone", because it is possible to claim that the end-point configurations themselves are relative. For example, Goldsmith (1976) accounts for the Igbo facts above by means of a convention that the high pitch register shifts downward whenever a low or downstepped high tone follows a high or downstepped high tone. (The low pitch register shifts in the same way -- presumably it is established in relation to the high pitch register.) Nevertheless, though facts of this sort do not argue AGAINST a level-tone theory, they at least suggest that tone is a sufficiently different sort of phenomenon from segmental phonology that one should not be hesitant to approach it from a different point of view. In particular, one should not be hesitant to consider the hypothesis that it is not the end-point pitch levels which are significant in tone contours, but rather the changes which take place between them. In this dissertation, I will argue that it is not only reasonable but very enlightening to look at tone from this point of view, for again and again, tonal phenomena which seem surprising and even bizarre when described in level-tone terms become logical and intelligible when viewed as part of a dynamic-tone system. The particular dynamic-tone theory which will be proposed here differs from those proposed by Hattori and Crystal in two important ways. First, it is a PURELY dynamic-tone theory, which represents tone contours entirely in terms of the two primitives ↓ (representing a fall in pitch) and ↑ (representing a rise in pitch). I will call these primitives "tone markers". Secondly, it is intended to be a universal theory of tone. In particular, I will argue that the theory proposed here may be applied with advantage to "tone" languages such as Igbo or Mandarin, to "pitch-accent" systems like Japanese and Serbo-Croation, and to languages like English, which do not have lexical tone. The exposition of this theory and of its consequences for linguistic theory in general will be organized as follows:

In the first three chapters, I will show how the theory accounts for a wide variety of tonal phenomena, including pitch-accent language (Chapter I), tone languages (Chapter II) and languages with phrasal tone (chapter III).

In Chapter IV, which is concerned with the nature of tone rules, I will show that in the theory proposed here tone rules may be confined to three processes: (i) the insertion of a tone marker, (ii) the movement of a tone marker, and (iii) the deletion of a tone marker. Constraints on the nature of tonal processes within each of these three categories will also be proposed.

Chapter V deals with some miscellaneous topics which could not easily be fit into other chapters, including (i) the phenomenon of tonal "stability" discussed by Goldsmith (1976), whereby the tone contour is often preserved in the face of radical alterations in the phonological string which carries it, and (ii) a further exploration of the consequences of the theory of gliding tones which is assumed in the preceding chapters.

The sixth and seventh chapters are devoted to a detailed analysis of the tonal system of Igbo, with particular attention to the specification of syntactic environments for the major tonal processes of that language. The distribution of certain tonal phenomena is shown to provide evidence for the internal structure of noun phrases in Igbo and for the "X-bar" theory of syntactic categories which was proposed by Chomsky (1970).

In Chapter VII, which is concerned with the tonal properties of the many "verb forms" of Igbo, I will argue against the notion of "tone formulas" which has been used by Leben (1970), McCawley (1970b), Goldsmith (1976). and others, to account for tonal paradigms of this sort. On the positive side, I will show that the characteristic tone contours of the verb forms of Igbo can be accounted for in a dynamic-tone theory by means of a simple set of lexical-structure conditions in combination with independently-motivated surface-level rules.

Finally, in Chapter VIII, I will investigate the interaction between phonology and syntax, and will propose a constraint which restricts the access which phonological processes have to information about syntactic structure. This constraint, which I will call the Structural Analysis Principle, will be shown to be compatible only with a theory of tone of the sort proposed here, and not with level-tone theories such as the autosegmental theory proposed by Goldsmith (1976).

FOOTNOTES TO THE INTRODUCTION

[1] Winston (1960) and Stewart (1971) make use of a "mixed" notation system for tone languages, in which the distinction between high and low tone levels is marked by means of level-tone features which are associated with the vowels, but there is also a dynamic-tone unit (!) which lies between syllables and indicates a lowering of the high and low pitch registers.

[2] At the phonetic level, tone markers may be specified not only for direction, but also for the size of the tone change which they represent; for example, there may be a distinction between a large pitch drop ($\big\downarrow$) and a small one ($\downarrow$). Distinctions of this sort can probably be confined to the phonetic level. In other words, in underlying representations we have only the binary distinction tetween a fall and a rise, but differences in degree of fall or rise may be established later, by phonological rules of the type assumed by Chomsky and Halle (1968), which convert the binary distinctive-feature specifications of the phonological level into numerical coefficients along a physical scale.

CHAPTER I

THE ANALYSIS OF PITCH-ACCENT SYSTEMS

1. Tokyo Japanese: McCawley's Analysis

In his dissertation, *The Phonological Component of a Grammar of Japanese*, McCawley observes that Tokyo Japanese is a pitch-accent language, where a pitch-accent language may be defined roughly as one which singles out one syllable per word for special pitch prominence. In particular, in Tokyo Japanese, there is at most one syllable per word which has a drop in pitch after it. The location of the drop in pitch varies from one word to another, so that we find, for example,

(1-1) a. ?i\noti 'life'

b. ko/ko\ro 'heart'

The word *?i'noti* has its drop in pitch (or "accent") after the first syllable, while the accent of *koko'ro* comes after its second syllable. (I follow McCawley's notation here in using an apostrophe to mark the position of the accent.) There are also nouns like *?atama'* 'head', which are accented after the final syllable. The word-final accent shows up, for all speakers, when the word is followed by an enclitic such as *ga* (the nominative marker), as in

(1-2) ?a/tama\ga 'head' with nominative marker

Individual speakers differ as to whether or not they pronounce a word-final accent at the end of a phrase; for example, *?atama'* in isolation may be pronounced in either of the following ways:

(1-3) a. ?a/tama

b. ?a/tama\

Some words, for example *miyako* 'city', are unaccented; such words are pronounced without a drop in pitch, as

(1-4) a. mi/yako 'city'

b. mi/yako ga 'city' with nominative marker

Notice that once one knows the position of the accent of a Japanese word, or that there is none, the tone contour of the whole word is predictable, for the first syllable is always low-toned unless it is followed by the accent, everything between the first syllable and the accent is high-toned, and everything which follows the accent is low-toned.[1]

McCawley accounts for these facts by marking some one position of each word with the feature [+acc]. This is a diacritic feature without phonological content; McCawley assigns the pitch contour itself by means of the following rules, which assign tone-level features to segments, using the position of the diacritic feature [+acc] as a reference point:

(1-5) i. Everything becomes high-pitched.

ii. Everything after the first mora of the accented syllable becomes low-pitched.

iii. The first mora of the phrase becomes low-pitched if the second is high-pitched.

There remains the question of what the feature [+acc] is a feature OF. If it were a feature of syllabic segments, then we would find at most *n* potential accent positions in a word *n* syllables in length. However, there are *n + 1* accent positions in such a word, for the pitch drop which realizes the accent can come at the end of a word (as in *ʔatama'* (1-2)), between any two syllables of a word (as suggested by the examples of (1-1)), or at the beginning of a word. The particles *'tati* (a pluralizer) and *'sika* 'only' are two words which make use of the word-initial accent position. Their "pre"-accents show up on the surface in the following examples with the unaccented nouns *miyako* 'city' and *kodomo* 'child':

(1-6) mi/yako\sika 'only a city'

ko/domo\tati 'children'

Since there are *n + 1* potential accent positions in a word with only *n* syllables, the feature [+acc] cannot be a feature of the syllables themselves. However, if we assume that there is a syllable boundary at the beginning and end of every word, as well as between any two consecutive syllables, then the number of potential accent positions is the same as the number of syllable BOUNDARIES. McCawley concludes that the feature [+acc] must be a feature of the syllable boundary.

We have established the fact that there is at most one pitch drop or "accent" in the lexical representation of a word of Tokyo Japanese. This pattern of one accent per word is maintained in the surface form when elements such as the copula *de'su* or particles such as *ga* (nominative marker), *kara'* 'from', *ma'de* 'up to', etc., are attached to the end of a noun. That is not surprising in the case of the particle *ga*, which has no accent of its own. However, the copula *de'su* and the particle *ma'de* have accents, and those accents show up on the surface when these items follow unaccented nouns such as *miyako*; for example, we find

(1-7) mi/yako de\su 'it's a city.'

In contrast, when *de'su* follows an accented noun, only the accent of the noun shows up, as in the examples

(1-8) ?i\noti desu 'It's a life.' (?i'noti)

ko/ko\ro desu 'It's a heart.' (koko'ro)

?a/tama\desu 'It's a head.' (?atama')

To account for the absence of an accent on *de'su* when it is preceded by an accented noun, McCawley introduces an "accent-reduction" rule, which has the effect of eliminating any accent following the first accent of a word. In writing the rule, McCawley makes use of a convention like that employed by Chomsky and Halle (1968) in writing the stress rules of English. Chomsky and Halle proposed that any rule which re-assigned primary stress to a primary-stressed vowel would automatically result in the reduction of stress on every other vowel within the domain of the rule. For example, when the Nuclear Stress Rule assigns primary stress to the last primary-stressed vowel of

(1-9) big deal

1 1

the stress level of "big" is reduced to secondary, and the stress pattern of the phrase becomes

(1-10) big deal

2 1

McCawley assumed a similar convention for rules involving the features [+acc] (=[1acc]), whereby the re-assignment of a positive value for this feature to any syllable-boundary of the word would reduce all other occurrences of [+acc] within the word to [-acc] (=[2acc]). McCawley stated his "accent-reduction rule" for Tokyo Japanese in the following way:

(1-11) $\sigma \rightarrow [1\ \mathrm{acc}]\ /\ \ldots \_\_\_ \ldots$ [2]

where the first ... contains no [1 acc] and where "σ" stands for "syllable boundary".

However, the accent-reduction convention is not an essential part of McCawley's analysis, for without the convention, the rule could be written as follows:

(1-12) $[+\mathrm{acc}] \rightarrow [-\mathrm{acc}]\ /\ \ldots [+\mathrm{acc}] \ldots \_\_\_ \ldots$

In this form, the rule simply eliminates all occurrences of the feature [+acc] within its domain except the first.

2. Tokyo Japanese: A Dynamic-Tone Analysis

McCawley's introduction of the diacritic feature [+acc] is a consequence of his assumption that tone contours are to be represented, ultimately, as sequences of level tones. Having made this assumption, he has no way to express directly the generalization that there is at most one drop in pitch in a word of Tokyo Japanese, but must resort to a diacritic feature whose number of occurrences per word can be controlled and which then serves as a reference point for the assignment of the tone contour. I will now propose an alternative analysis in which the "accent" of a Japanese word is assumed to be a drop in pitch at all levels of the derivation. Representing this pitch drop with a downward arrow, ↓, we may set up lexical representations of the following sort for Tokyo Japanese:

(2-1)	?i↓noti	'life'
	koko↓ro	'heart'
	?atama↓	'head'
	miyako	'city'
	de↓su	'it is'
	↓sika	'only'
	ga	nominative marker

The fact that there is at most one ↓ and no ↑ in the lexical representation of a word may be stated by means of the following lexical structure condition:

(2-2) In a word of the form $[\underset{1}{\ldots}\ \underset{2}{\text{tone marker}}\ \underset{3}{\ldots}]$,

2 is a ↓, and 1 and 3 contain no tone markers.

In this system, the rule which accounts for the loss of the "accent" of *de↓su* and *↓sika* in the phrases

(2-3) a. koko↓ro + de↓su → koko↓ro desu 'it's a heart.'

b. koko↓ro + ↓sika → koko↓ro sika 'only a heart'

will be stated as follows:

(2-4) T-after-T Deletion

s.d. $\underset{1}{\ldots}\ \underset{2}{[+\text{tone}]}\ \underset{3}{\ldots}\ \underset{4}{[+\text{tone}]}\ \underset{5}{\ldots}$

s.c. $4 > \emptyset$

This rule deletes every tone marker within its domain except for the first; in particular, it deletes the underlying ↓'s of *de↓su* and *↓sika* in the phrases of (2-3). A subsequent rule inserts a pitch rise after the first syllable of each of these phrases, producing the surface tone contours *kokoro desu* and *kokoro sika*. Rule (2-4) does not, of course, apply to underlying forms like

(2-5) a. miyako de↓su 'it's a city.'

b. miyako ↓sika 'only a city'

In which there is only one ↓. I have not specified a syntactic environment for rule (2-4), not having sufficient evidence to decide exactly what its domain should be. The syntactic environment of the rule is immaterial to our purposes, which are to find the best possible way of describing the tonal phenomenon itself.

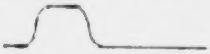
There is an obvious relationship between the rule of T-after-T Deletion above and the lexical structure condition (2-2). It is predictable that a language with a tone-marker deletion rule like this one will also have the lexical structure condition of (2-2), since the fact that there is at most one pitch drop per word in the surface form means that, in general, children learning the language will have evidence for postulating no more than one pitch drop per word in lexical representation. Exceptions to this generalization might be found, however, if the rules of the language were such as to cause the single pitch drop to appear sometimes in one position and sometimes in another in the surface form. Children learning such a language might be led to set up lexical representations with two pitch drops per word even though only one of these would appear in any surface realization of the word. Notice that there is no implication at all in the other direction; that is, the fact that a language contains a lexical structure condition of the form of (2-2) does not predict that it will also contain a tone-marker deletion rule of the form of (2-4).

The assumptions we have made about lexical representation, together with the rule of T-after-T Deletion (2-4) account for the position of the pitch drop in Japanese nouns and in most noun-particle combinations. We will also need a rule inserting the pitch rise which is found after the first syllable of most words. Using an upward arrow, ↑, to represent a pitch rise, we may state a rule for its insertion in the following way:

(2-6) Pitch Rise Insertion

$$\emptyset \rightarrow \uparrow / \$ \, \sigma_1 \; \_\_\_ \; \sigma_2$$

where σ_1 is the first syllable of a phrase, and is followed by another syllable, with no intervening tone marker. Rule (2-6) applies, for example, to the underlying form *koko↓ro desu* (2-4a), to give the output form



(2-7) ko↑ko↓ro desu

The rule does not apply to words like *ʔi↓noti* 'life', which have their pitch drop after the first syllable.[3]

3. Representing Tone Contours with Dynamic Tones: the Distribution and Realization of Tone Markers

In the analysis outlined above, the tone contours of Japanese words were represented by means of the tone markers ↓ and ↑, which appear in the phonological string at points of pitch change and indicate the direction of change. These two tone markers are, I believe, the only units needed for the representation of tone contours in all languages.[4] They may be represented more formally by means of the feature matrices $\begin{bmatrix}+\text{tone}\\+\text{fall}\end{bmatrix}$ (for↓) and $\begin{bmatrix}+\text{tone}\\-\text{fall}\end{bmatrix}$ (for ↑), where the feature [±tone] serves to differentiate these two units from the phonological segments, and the feature [±fall] distinguishes them from one another. Tone markers have phonetic content, in that they represent changes in the tension, thickness, and position of the vocal cords which result in a change in the pitch of the voice; however, that change is realized only through its effect on the surrounding tone-bearing units -- there is no way to pronounce a tone marker in isolation.

The distribution of tone markers in the string is governed by the following well-formedness conditions:

(3-1) a. No tone marker may appear inside a tone-bearing unit (where the tone-bearing unit for a given language may be either the syllable or the mora), and

b. Two tone markers within the same word must be separated by a tone-bearing unit.

As applied to Tokyo Japanese, whose tone-bearing unit is the syllable, the well-formedness conditions insure that tone markers will appear only at syllable boundaries, and only one per syllable boundary; that is, they insure that tone markers will appear only at the potential accent positions which were observed by McCawley. I assume that these well-formedness conditions obtain at all stages of the derivations; in other words, configurations of the form

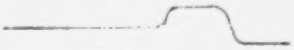
(3-2) $[\ldots[+\mathrm{seg}][+\mathrm{tone}][+\mathrm{seg}]\ldots]_{\mathrm{TBU}}$ or

$[\ldots[+\mathrm{tone}][+\mathrm{tone}]\ldots]_{\mathrm{word}}$

where TBU stands for "tone-bearing unit", are not permitted in either underlying or surface forms.[5] We will prevent the occurrence of configurations of the second sort by means of a convention that the insertion of a tone marker at the boundary of a tone-bearing unit causes the automatic deletion of any tone marker which already occupies that boundary. Similarly, we will rule out configurations of the first type by means of a convention that whenever phonological processes which affect the placement of syllable boundaries would result in the entrapment of a tone marker inside a tone-bearing unit, that tone marker automatically moves to the nearest boundary of a tone-bearing unit, where the "nearest" boundary is the one which does not require the tone marker to pass over the syllabic nucleus. This convention will be elaborated and adjusted somewhat in connection with the discussion of tonal "stability" in Chapter V.

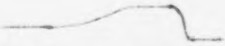
The particular way in which a tone marker is realized depends on the language and on the context in which it appears. In a great many languages whose tone-bearing unit is the syllable, the change in pitch which a tone marker represents is executed AS SOON AS POSSIBLE AFTER THE NUCLEUS OF THE SYLLABLE WHICH PRECEDES IT. This means, in effect, that a tone marker which follows a long syllable is realized as a gliding tone on that syllable. In contrast, a tone marker between two syllables, the first of which is short, is realized as a sharp change in pitch in the vicinity of the syllable boundary. Thus, in English, there is a difference in the way in which the pitch rise is realized in the two phrases

(3-3) a.



an English ↑tea↓cher (= a teacher who is English)

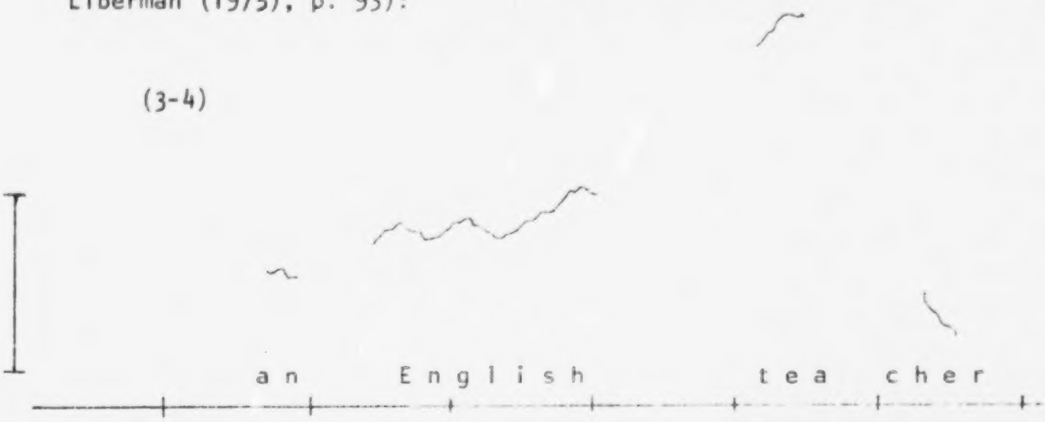
b.



a fine ↑tea↓cher

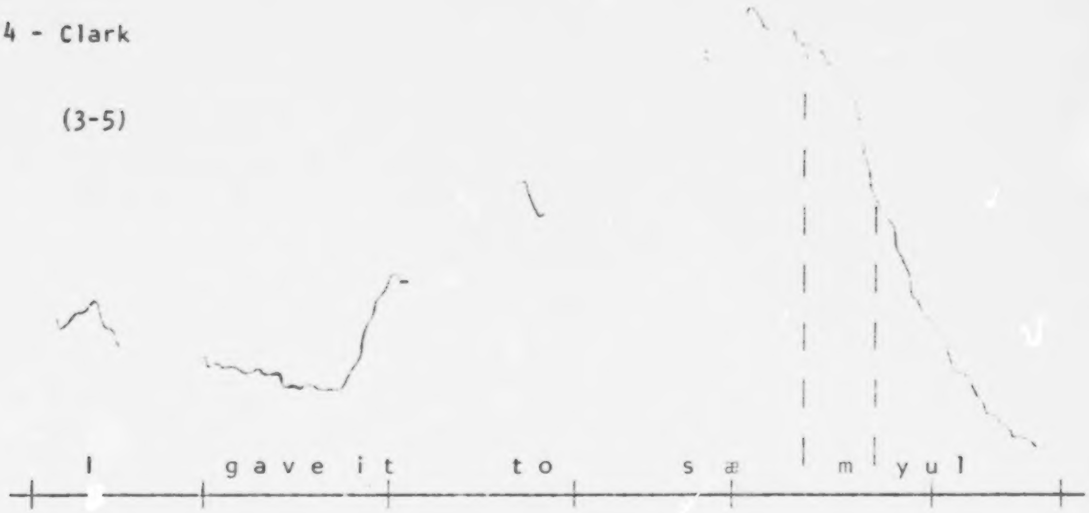
When the syllable preceding the ↑ is short, as in (a), the pitch rise is executed at the syllable boundary, as indicated in the rough tone contour which appears above this phrase, and in the F_0-contour of this phrase which is given below (taken from Liberman (1975), p. 93):

(3-4)

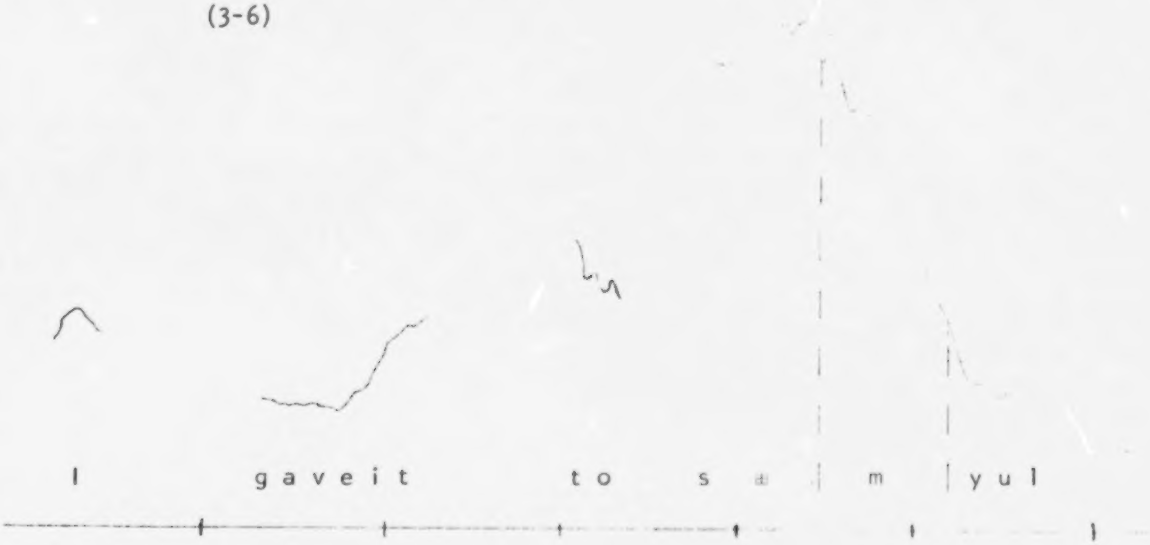


Similarly, the pitch drop after the durationally short syllable *tea* of *teacher* is an abrupt drop in pitch executed at the boundary of the two syllables *tea* and *cher*, during that part of the utterance which is insufficiently voiced to register on the pitch extractor. However, when the syllable preceding a tone marker is long, as is the syllable *fine* in (3-3.b)[6] the change in pitch which that tone marker represents is executed largely during that syllable, so that *fine* in (3-3.b) is pronounced with a rising glide. I have no F_0-contour of this particular phrase, but the following two versions of the statement *I gave it to Samuel*, again from Liberman (1975)(pp. 154-5) bear out the point which is being made here, that the degree to which a tone marker is realized during the syllable preceding it in English depends on the length of that syllable.

(3-5)



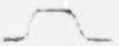
(3-6)



If the two contours (3-5) and (3-6) are superimposed upon one another, matching the starting points of the two [m]'s, then their downward curves will be seen to match very closely; in particular, the rate at which the frequency decreases from that point is virtually the same in the two cases. The chief difference between these two pronounciations of the same sentence is in the length of their two [m]'s, the duration of the latter [m] being nearly twice that of the former. The result is that while most of the pitch drop of (3-6) is absorbed by the latter half of the syllable [sæm], the pitch drop of (3-5) continues into the following syllable, [yul]. These pitch contours tend to confirm the observation that in English a tone marker is realized as soon as possible after the nucleus of the syllable which precedes it,[7] so that the extent to which the change in pitch is executed during that syllable depends upon the length of the syllabic coda (i.e., on the length of that part of the syllable which follows the nucleus of the syllable.)

The same principle holds for Tokyo Japanese, where it is a well-known fact that a tone change which follows a short syllable is executed at the boundary between that syllable and the next, as in

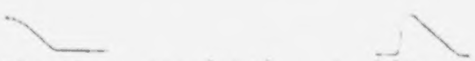
(3-7)



ko↑ko↓ro

but when the syllable preceding the tone marker is a long one, the pitch change is made during that syllable, as in, for example,

(3-8)

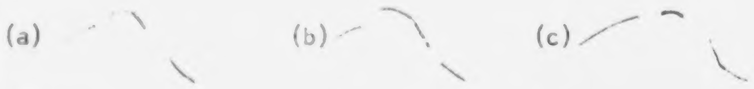


a. ↑kon↓ban 'tonight' b. ki↑noo↓ 'yesterday'

There is never a pitch change at the end of a long syllable in Tokyo Japanese. Thus I will assume, with McCawley, that there is only one position per syllable which may be marked for tone in Tokyo Japanese; the difference in the realization of tone markers after long and short syllables is a result of the convention[8] that a tone marker is to be realized as soon as possible after the nucleus of the syllable which precedes it.

This convention is very widespread among languages, for it apparently also holds in Serbo-Croation. Thus, according to Lehiste, words with "rising accent" (for which I assume the tone marking $[\sigma_1 \uparrow \sigma_2 \downarrow \ldots]$ (where "σ" stands for "syllable") may have any of the following tone contours, depending upon whether the syllables are (a) short, short, short (b) short, long, short, or (c) long, short, short.

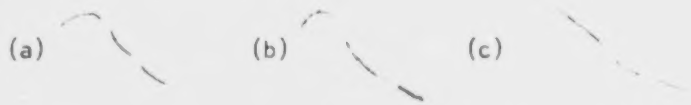
(3-9)



The diagrams above, taken from Lehiste (1970)(p. 87), show that the extent to which a tone marker is realized during the syllable preceding it depends in Serbo-Croation, as in English and Japanese, on the length of that syllable. Thus in (b), where the syllable preceding the ↓ of the tone contour is a long one, that syllable absorbs more of the pitch drop than do the second syllables of (a) and (c), which are short. Similarly, in (c) where the syllable preceding the ↑ of the tone contour is long, the pitch rise is already completed by the end of that syllable, but in (a) and (b), where the syllable preceding the ↑ is short, the pitch rise continues into the following syllable. However, the first syllable of a word with rising accent is always lengthened to some extent (according to Lehiste, a short syllable in this position has the duration of a long syllable, and an underlyingly long syllable is lengthened still more), so that even in (a) and (b), the first syllable of the word absorbs a considerable part of the pitch rise.

Now consider words with "falling accent", for which I assume the tone representation $[\uparrow\sigma_1\downarrow\sigma_2\ \ldots]$. Lehiste's pitch contours are given below for words of this sort with the syllable-length patterns (a) short, short, short (b) short, long, short, and (c) long, short, short.

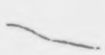
(3-10)



These pitch patterns support the observations that the extent to which a tone marker is realized during the preceding syllable in Serbo-Croatian depends on the length of that syllable, for in (c), where the syllable preceding the ↓ of the tone contour is relatively long, most of the pitch drop is executed during that syllable, but in (a) and (b), in which the syllable before the ↓ is relatively short, that syllable absorbs less of the pitch drop.

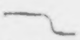
We have seen that English, Tokyo Japanese, and Serbo-Croatian follow a convention whereby a tone marker between two syllables is realized as a gliding tone on the first syllable if that syllable is long. Some languages which follow this convention for a tone marker which comes after a long syllable within the same word do not follow it when the long syllable and the tone marker which follows it are in different words. For example, in Igbo, a syllable at the end of a word is lengthened under certain circumstances, and a tone marker which comes after that syllable within the same word is realized as a gliding tone on it. However, there are no circumstances under which a tone marker at the beginning of a word is realized as a gliding tone on the final syllable of the PRECEDING word. Thus we find a contrast between the two phrases

(3-11) a.



isi↓Chi 'Chi's head'

b.

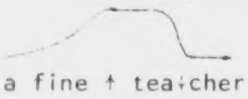


isi↓ji 'the head of a yam'

where the ↓ of the first phrase is the final element of the word *isi* 'head', and it is realized as a falling glide on the final syllable of that word, but the ↓ of the second phrase is the first element of the word *ji* 'yam', and is realized as a sharp change in pitch at the syllable boundary. The contrast in the realization of the pitch drop in phrases like these will be discussed in greater detail in connection with the analysis of Igbo tone which is presented in Chapter II.

While Japanese and Mende appear to follow the same convention as Igbo with respect to the pronunciation of a word-initial tone marker (namely, that it is never realized as a gliding tone on the preceding syllable), English does not, as can be seen from the example of (3-3.b), repeated below:

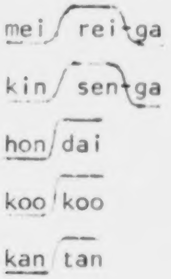
(3-12)



in which the ↑ of the tone contour is realized as a rising glide on the syllable *fine* even though it is inserted, I assume, in the environment of the main-stressed syllable *tea* and so is the first element of the word *teacher* rather than the final element of the word *fine*.

In the languages we have looked at so far (English, Tokyo Japanese, and Serbo-Croatian) a tone marker between two syllables is realized as a gliding tone on the preceding syllable if that syllable is phonetically long, but otherwise as a fairly sharp change in pitch at the syllable boundary. There are other languages in which a tone marker between two syllables is executed at the syllable boundary in every case, whatever the length of the first syllable. Kagoshima Japanese is such a language, as Haraguchi (1975) has pointed out. Some of Haraguchi's examples from Kagoshima Japanese are listed below:

(3-13)



mei rei↓ga	'order' + nominative marker
kin sen↓ga	'money' + nominative marker
hon dai	'payment for book'
koo koo	'filial piety'
kan tan	'simplicity'

Northern Tepehuan is another language of this type, for in the following examples cited by Woo (1969), the tone change between two syllables is executed at the syllable boundary even when the preceding syllable is long:

(3-14)	daadaka	'noses'
	baabahi	'tails'
	kukuntagi	'They take a husband'
	onaikɨdɨ	'with the salt'
	sosoañi	'They cried'

We have seen above that there are two possibilities for the realization of a tone marker which follows a long syllable. In some languages, such a tone marker will be realized as a gliding tone on the preceding syllable; however other languages realize a tone marker between two syllables at the syllable boundary even when the first syllable is long. There are also apparently languages which mix the two systems. Morris Halle has pointed out to me that in modern Greek a pitch change after a syllable with a long vowel is realized as a gliding tone on that syllable, as in English, Japanese, and Serbo-Croatian. However, a tone change which comes after a syllable which ends with a nasal is realized at the syllable boundary, as in Kagoshima Japanese and Northern Tepehuan.

In the languages we have looked at so far, the basic tonal unit is the syllable; in other words, in these languages, tone changes come no more frequently than one per syllable. There are also languages in which the basic tone-bearing unit is the mora. Osaka Japanese is such a language, as can be seen from the following examples, taken from Haraguchi (1975):

(3-15)	sendati	'pioneer'
	onna	'woman'
	onda	'temperature'

In the theory being proposed here, these words have the tone representations

(3-16) a. se↑n↓dati

b. ↑o↓nda

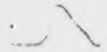
c. ↑on↓na

Example (a) shows that in Osaka there may be two tone markers associated with the same syllable, one after the first mora of the syllable, and one after the second. Similarly, examples (b) and (c) show that the ↓ of the lexical tone contour may come after the first or the second mora of a long syllable, with a contrast between the two. In Osaka, and, I assume, in all mora-tone languages, a tone marker between two moras is realized as a change in pitch at the mora boundary.

Just as languages may differ in the way in which they realize a tone marker at the boundary between two tone-bearing units of a particular sort, so they may differ in the way they pronounce a tone marker at the beginning or at the end of a breath-group. Some languages pronounce such a tone marker as a gliding tone on the adjacent tone-bearing unit, even if that unit is short; other languages do not pronounce a tone marker under these circumstances. Thus, according to Haraguchi, some speakers of Tokyo Japanese pronounce accent-final nouns like *ʔa↑tama* 'head' with a falling glide on the final syllable when they occur in isolation or at the end of a breath group; other speakers do not pronounce the ↓ of such a word unless there is other material following it within the phrase. All speakers pronounce a word-final accent when the preceding syllable is long, as in *ki↑noo↓* 'yesterday'.

Two other languages which pronounce a tone marker at the end of a breath group are English and Mende. Examples are given below of phrases in these languages which end with tone markers. The F_0-contours for the English phrases are taken from Liberman (1975), pp. 12 and 20.

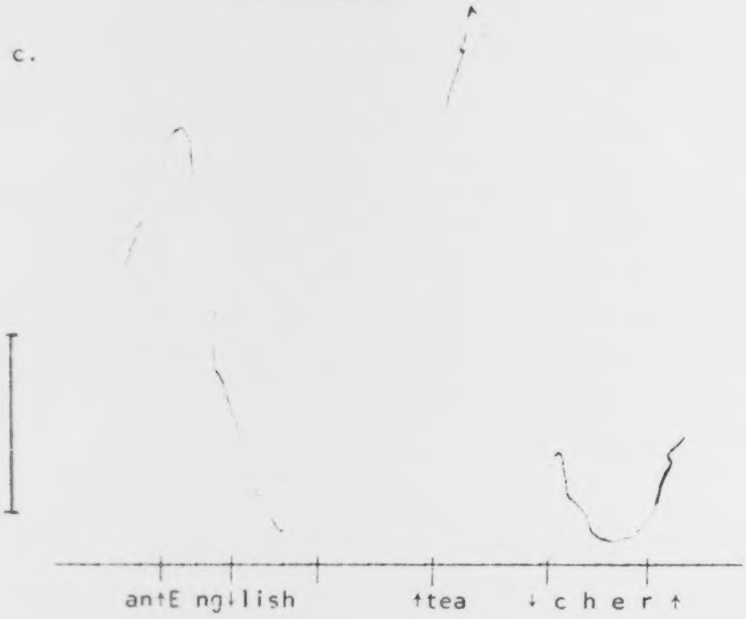
(3-17) From Mende



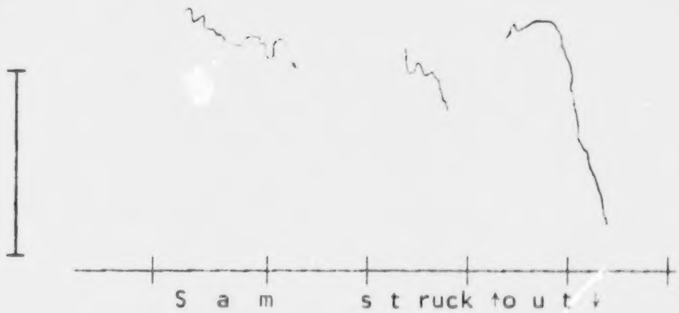
a. mba↑ 'rice'   b. nya↑ ha↓ 'woman'

From English

c.



d.

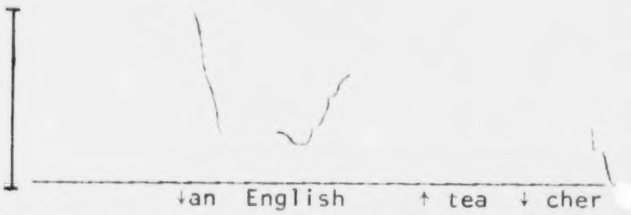


Liberman suggests that the phrase of (c) above might be pronounced with this intonation by "an Anglophobic anti-intellectual who has just been informed that his daughter is to marry a teacher of British origin."

Serbo-Croatian is another language which pronounces phrase-final tone markers. Lehiste (1970) reports that when a bi-syllabic rising-accent word (that is a word with the tone contour [$\sigma_1 \uparrow \sigma_2 \downarrow$]) comes at the end of a breath group, its ↓ is pronounced as a falling glide on the final syllable. When the final syllable is occupied in this way with the ↓ of the tone contour, the ↑ is displaced somewhat to the left, so that at the end of a breath group a word with rising accent acquires a tone contour resembling that of a word with falling accent. (See the pitch diagrams of (3-9) and (3-10).) Two languages which do NOT pronounce a tone marker at the end of a breath group are Igbo and Northern Tepehuan.

Languages also differ as to whether or not they pronounce a tone marker at the beginning of a breath group. If such a tone marker is to be pronounced, it must, of course, be realized as a gliding tone on the syllable which follows it, the first syllable of the phrase.[9] The gliding tone at the beginning of the English phrase below (F_0-contour from Liberman (1975), p. 12) is the realization of a phrase-initial ↓.

(3-18)



Liberman suggests that a pitch drop at the beginning of a phrase in English adds "vivacity, liveliness, excitement and vehemence" to the utterance.

Igbo is another language which pronounces a phrase-initial tone marker as a gliding tone on the first syllable, as in the clause

(3-19)

↓ọ zụta↑ya 'lest he buy it'

he + buy + it

Independent motivation for positing a ↓ at the beginning of this phrase will be given in Chapter VII, which contains a detailed analysis of the tonal properties of verbal phrases in Igbo.

Serbo-Croatian provides examples of the pronunciation of a ↑ at the beginning of a phrase. According to Lehiste (1970), a word with "falling accent" (for which I have assumed the tone representation $[{\uparrow}\sigma_1 {\downarrow}\sigma_2 \ldots]$) is pronounced with a noticeable rise in pitch on the first syllable when it occurs in phrase-initial position, so that a word with falling accent in this position has a pitch contour resembling that of a word with rising accent. This variation in the pronunciation of falling-accent words in phrase-initial position is to be expected in a language which pronounces phrase-initial tone markers, for the pitch rise of the tone contour must in this case be absorbed entirely by the first syllable of the word, and it is natural that the drop in pitch should then be displaced somewhat to the right, onto the second syllable, where it would normally be found in a word with rising accent (see the pitch contours of (3-9) and (3-10).) Japanese and Mende are two languages which do not pronounce phrase-initial tone markers.

There is one other sort of variation in the realization of tone markers which requires some comment. Liberman (1977) has pointed out that phrases of English which in his theory have the tone representation

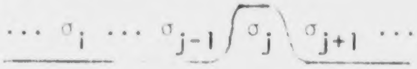
(3-20) $\ldots \underset{L}{\overset{|}{\sigma_i}} \quad \ldots \sigma_{j-1} \; \underset{H}{\overset{|}{\sigma_j}} \; \underset{L}{\overset{|}{\sigma_{j+1}}} \ldots$

and which in my theory will have the representation

(3-21) $\ldots \sigma_i \ldots \sigma_{j-1} \; {\uparrow}\sigma_j \; {\downarrow}\sigma_{j+1} \ldots$

do not ordinarily have the pitch contour

(3-22)



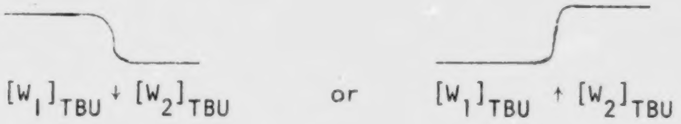
$\ldots \sigma_i \ldots \sigma_{j-1} \; \sigma_j \; \sigma_{j+1} \ldots$

but instead are pronounced with a gradual rise in pitch beginning some syllables before σ_j, though the greatest part of the pitch rise will, of course, occur between the syllables σ_{j-1} and σ_j. Similarly, though the greatest part of the fall in pitch will occur between the syllables σ_j and σ_{j+1}, there may be a gradual decrease in the fundamental frequency persisting throughout several subsequent syllables. Examples of this phenomenon, which I will call "corner-cutting", may be found, for English, in the pitch diagrams of (3-4), (3-5), and (3-6), and, for Serbo-Croatian, in the pitch diagrams of (3-10).

If, when, and to what degree corner-cutting takes place undoubtedly varies from language to language, from speaker to speaker within a given language, and even for a single speaker from one occasion to another.

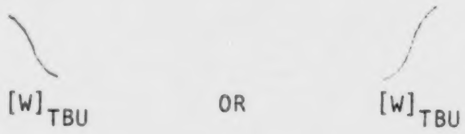
In summary, in the theory which is being presented here, tone contours are represented entirely by means of the tone markers ↓ and ↑, which represent a fall in pitch and a rise in pitch respectively. When the pitch change which a tone marker represents takes place at the boundary between two tone-bearing units, the resulting tone contour looks more or less like this:

(3-23)


$[W_1]_{TBU} \downarrow [W_2]_{TBU}$
or
$[W_1]_{TBU} \uparrow [W_2]_{TBU}$

with the adjacent tone-bearing units W_1 and W_2 on different pitch levels. Alternatively, the pitch change which a tone marker represents may be executed during a tone-bearing unit, creating a "gliding" tone which looks like this:

(3-24)



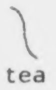
The pitch contours of (3-23) and (3-24) are, of course, idealizations; the realization of a tone marker in actual fact often lies somewhere between these two extremes. Tone markers are always located at the boundaries of tone-bearing units, with their realization in any particular case determined by conventions which are partly universal and partly language-specific. The realization of a tone marker as a gliding tone on a single tone-bearing unit has been found to result from conventions of the following sort: (i) in some languages, a tone marker which follows a durationally long syllable is realized as a gliding tone on that syllable, (ii) in some languages, a phrase-final tone marker is realized as a gliding tone on the preceding tone-bearing unit even if that unit is short, and (iii) some languages realize a tone marker at the beginning of a phrase as a gliding tone on the first tone-bearing unit of the phrase. It is a fundamental assumption of the theory that any gliding tone on a single tone-bearing unit will be derivable by means of conventions of this sort.

4. An Examination of some Competing Theories of Gliding Tones

The occurrence of a rising or falling tone on a single syllable has been of concern to generative phonologists since Wang (1967) first attempted to establish a set of distinctive features (such as [±high]) and dynamic-tone features (such as [±rising] and [±falling]). For example, a tone which falls from a high tone-level to a mid tone-level (˥˧) is defined in Wang's system as [+high, +contour, +falling], while one which rises from a low tone-level to a mid tone-level (˩˧) is defined as [-high, +contour, +rising]. Wang regarded these features as features of the whole syllable, rather than of any one segment, for a rising or falling tone may be spread over two tone-bearing segments in a long syllable (as in the Japanese *hon* 'book').

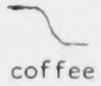
Woo (1969) argued against Wang's feature system on the grounds that languages generally treat a gliding tone on one syllable as equivalent in some way to a sequence of distinct level tones on succeeding syllables. We have already seen an example of this kind of equivalency in Tokyo Japanese, where the "accent" of a word may be realized either as a fall from high to low within a single long syllable (as in *hon*) or as a high-low sequence spread over two syllables (as in *saru* 'monkey'). Another familiar example comes from English, where the pitch phenomenon which is most frequently associated with the primary-stressed syllable of a phrase is a falling glide on that syllable if it is the last syllable of the phrase, as in

(4-1)



but may be a high-low sequence spread over two syllables if the primary-stressed syllable is not phrase-final, as in

(4-2)

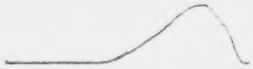


Wang's feature system obscures the equivalency between a gliding tone and a sequence of level tones in cases like this, because in Wang's system the tone contour of (4-1) would be represented by the single tone-specification [+high, +contour, +falling], but the tone contour of (4-2) would be expressed as the tone sequence [+high, -contour], [-high, -contour], and the two representations have very little in common.

Having discovered this flaw in Wang's feature system, Woo proposed an alternative theory in which gliding tones are analyzed as sequences of level tones -- for example, the falling glide \| is analyzed as an instance of the sequence High, Low, and the rising glide /| is considered to be an instance of the sequence Low, High. Woo's theory allows a uniform treatment of the tone contours of words like *ho\n* and *sa\ru* in Tokyo Japanese, for both these words can be said to have the tone contour "High, Low".

Woo's treatment of gliding tones as sequences of level tones turns out to be incompatible in certain instances with her theory of tone representation, for she assumes that tone levels should be specified by means of features on sonorant segments, so that there is no way to represent a gliding tone on a syllable which contains only one sonorant segment. Such gliding tones do exist, however. For example, as we have seen, there are dialects of Japanese in which the word *ʔo↑toko↓* 'man' is pronounced with a falling glide on its final syllable when it is spoken in isolation, a pronunciation for which Woo's theory provides no representation. Similarly, Woo's theory provides no way of representing the rising glide on the syllable *black* or the falling glide on the syllable *hat* in

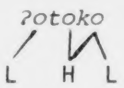
(4-3)



It's a black↑ hat↓.

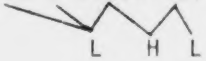
because these syllables, though phonetically long, are not long underlyingly, and there is no reason to suppose that they should be represented phonetically with double vowels. Facts like these have led to the development of "autosegmental" or "suprasegmental" theories of tone in which the tone melody of a phrase is assumed to have an identity of its own, apart from the phonological string which carries it. In the autosegmental theory of Goldsmith (1976), the most complete development of this type of theory, the tone melody is represented as a sequence of tone segments, each of which represents a tone level. A tone melody becomes associated with a phonological string by a process of tone mapping, which establishes an association between individual tonological and phonological segments. For example, in this theory the tone contour of *ʔo↑toko↓* may be represented as

(4-4)



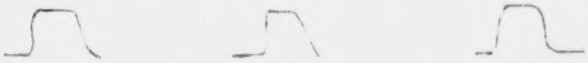
The fact that the final syllable of *ʔo↑toko↓* is pronounced with a falling glide is represented in this theory by associating it with both a high tone and a low tone segment; because the high tone segment and the phonological segments exist independently of one another, there is no necessity that they be associated with one another in a one-to-one fashion. The phrase of (4-3) could be represented in a parallel way, as

(4-5) It's a black hat.



Let us return now to Woo's argument that a theory of tone must be capable of expressing the functional equivalency between a gliding tone on a single syllable and a sequence of level tones spread over two or more syllables. Such an equivalency is expressed within a level-tone theory by analyzing a gliding tone as a sequence of level tones, as Woo proposed. In an autosegmental level-tone theory, a gliding tone can be analyzed as a sequence of level tones even if it occurs on a syllable which has just one sonorant segment, as in the examples of (4-4) and (4-5). Thus this theory is capable of expressing the generalization that words of Japanese and sentences of English quite generally have the tone contour LHL, though the changes from one tone level to another are made sometimes during a syllable and sometimes at a syllable boundary. However, it is not necessary to adopt an autosegmental level-tone theory in order to express generalizations of this sort. In particular, the dynamic-tone theory which has been presented here also satisfies Woo's criterion that a theory of tone must be capable of expressing the functional equivalency between a gliding tone on a single syllable and a sequence of level tones spread over two or more syllables. For example, the Japanese words

(4-6)



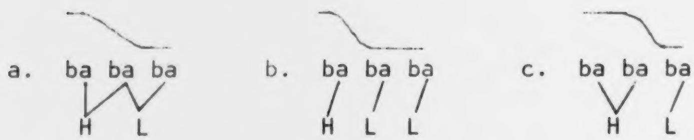
a. ʔo↑toko↓ b. ki↑noo↓ c. ko↑ko↓ro

'man' 'yesterday' 'heart'

have identical tone shapes (...↑...↓...) in dynamic terms just as they do in theories which analyze a falling glide as an instance of the tone sequence HL.

While the dynamic-tone theory and the autosegmental theory are apparently equivalent in their ability to express generalizations of the sort discussed above, the two theories are not equivalent in their ability to express a LEXICAL contrast between a gliding tone and a sequence of syllables on different tone levels. For example, the autosegmental theory is, in principle, capable of representing a three-way lexical contrast of the sort illustrated below:

(4-7)



The lexical items above differ only in tone contour; because the second syllable of (a) is associated with both a high and a low tone segment, it is pronounced with a falling glide, in contrast to (b) and (c), where the fall in pitch takes place sharply, at a syllable boundary.

The dynamic-tone theory is more restrictive than the autosegmental theory with regard to lexical contrasts of this sort. Since the words (b) and (c) above must have the tone representations *ba↓baba* and *baba↓ba* respectively, we know that this hypothetical language must pronounce a tone marker between the two [ba]'s as a sharp change in pitch at the syllable boundary. But there is then no way to represent the tone contour of (a); the restrictions on the distribution of tone markers will not allow us to place its ↓ in the middle of the second syllable, nor can we give this word the same tone representation as (b) or (c) and use conventions for the realization of tone markers to account for the difference in pronunciation. Phonetic realization conventions could not differ from one word to another within the same language -- tone markers in equivalent positions must be realized in the same way (or in the same range of ways, allowing for some free variation). Thus, in using conventions for the realization of tone markers to account for gliding tones, the theory predicts that lexical contrasts of the sort illustrated in (4-7) can not occur. This prediction of the dynamic-tone theory will be discussed in greater detail in Chapter V.

5. On the Notion 'Pitch-Accent Language' in McCawley's Theory and in a Dynamic-tone Theory

We have now considered analyses of Japanese pitch accent in two different theories. On the one hand, we have the dynamic-tone analysis, in which the tone contours of Japanese are represented at all stages of the derivation by means of the tone markers ↓ and ↑, with a lexical structure condition insuring that there is at most one tone marker in the lexical representation of any word and that that tone marker is a ↓. The loss of the second "accent" in phrases like

(5-1)

ko ko ro desu 'It's a heart.'

(from *koko↓ro* 'heart' + *de↓su* 'it is') is accounted for by means of a rule which deletes all but the first ↓ within its domain. This rule, and the lexical structure condition for Tokyo Japanese are repeated below:

(5-2) a. The Lexical Structure Condition (Repeated from (2-2))

In a word of the form [...tone marker...], 2 is a ↓,
1 2 3

and 1 and 3 contain no tone markers.

b. The Rule of T-After-T Deletion (Repeated from (2-4))

... [tone] ... [tone] ...

sd. 1 2 3 4 5

sc. Delete 4.

In contrast to the analysis above, we have McCawley's analysis, in which the position of the pitch drop of a Japanese word is marked with the diacritic feature [+acc], which is a feature of syllable boundaries. There is at most one occurrence of this feature in the lexical representation of any word, and the one-accent-per-word lexical structure is maintained in the surface form by a rule of accent-reduction, which eliminates all but the first occurrence of the feature [+acc] in any phonological word. The tone contour itself is assigned by a tone-assignment rule which assigns a tone-specification to each mora, using the diacritic feature [+acc] as a reference point.

In order to choose between these two analyses, we must consider the larger theories of which they form a part. In introducing the diacritic tonal feature [+acc], McCawley assumed that this feature would play a role only in a certain class of languages, called "pitch-accent" languages, which are distinct from the class of "tone" languages. Pitch-accent languages, of which Japanese is a paradigm case would have the following characteristics:

(5-3) i. The tone contours of the words of the language are completely specified in lexical representation by an indication of whether or not the word is accented and if so, where the accent occurs.

ii. The rules which affect pitch in the language are all of the accentual type; that is, there are accent-reduction rules which eliminate all but one accent of each word or phrase, and possibly also rules of accent deletion or accent movement, but there are no rules affecting the tone-level features which are assigned by the tone-assignment rules.

True tone languages, conversely, have the following properties:

(5-4) i. The tone contours of the words of the language are specified from the beginning by means of tone-level features such as [±high], and, in general, every segment which can bear tone in the surface form is marked for tone in the lexicon.

ii. The tone rules of the language are not of the accent-reduction type, but refer to the tone-level features, and are of the same assimilatory/dissimilatory character as the rules which affect purely segmental features such as voicing or nasality.

It seems unlikely that a language typology of this sort could be correct, for there is no principled reason why these properties should always go together in just this particular way. For example, it makes sense in McCawley's theory to claim that there can be no accent-reduction rules in a true tone language, because accent-reduction rules are stated in terms of the feature [+acc] -- it would be difficult to state them in terms of tone-level features -- and tone languages do not make use of this feature. But there is no reason why a pitch-accent language should not contain rules referring to tone-level features, though these rules would, of course, have to be ordered after the tone-assignment rules. The reason McCawley wanted to exclude such rules from pitch-accent languages is, apparently, that rules of this sort might destroy the one-accent-per-word tonal pattern which he takes as fundamental for a pitch-accent system. But there is no way within the theory of generative phonology to require that the whole grammar of a language be set up in such a way as to preserve a lexically-established pattern throughout the derivation. For this reason, it would be surprising, I think, if McCawley's typology were to hold up. In fact, it does not; in a later article entitled "Some Tonal Systems that Come Close to Being Pitch-Accent Systems But Don't Quite Make It" (1970), McCawley himself pointed out a number of counter-examples. For example, he pointed out that Ganda, a language of Uganda, has the one-accent-per-morpheme lexical structure which is typical of pitch-accent languages, and it also has one "accent-reduction" rule. But the grammar of Ganda also includes a number of other tone rules not of the pitch-accent type, the combined effect of which is to break up the one-accent-per-morpheme lexical pattern, producing a "tremendous profusion of surface tonal forms". Having found this and other counter-examples to his typology, McCawley abandoned it and substituted the weaker claim that in languages which contain both accent-reduction rules and rules referring to tone levels, the former must precede the latter.

At this point one begins to feel that the distinction which McCawley's theory makes between pitch-accent languages and tone is not a particularly useful one, for we can predict very little about a language from knowing that it belongs to one class or the other. Furthermore, providing different systems of lexical tone representation for the two sorts of languages introduces the problem of how to keep the two systems separate from one another. Thus if it is possible for a language to use either the diacritic feature [+accent] or tone-level features such as [±high] in marking lexical tone, then we might expect to find languages which mix the two. For example, we might expect to find a language which was like Japanese except that some words would be marked for tone. Suppose then that in this hypothetical dialect of Japanese, the unaccented noun *miyako* 'city' were assigned the lexical tone contour LHL, as shown below

(5-5) *mi ya ko

This noun would then have the same tone contour as the accented noun *koko'ro* 'heart'. However, the two nouns would behave differently when followed by an accented particle, or by the copula *de'su* because the fall from high to low in *ko ko ro* is an accent, and it would cause deletion, by the accent-reduction rule, of the accent of *de'su*, but the fall from high to low in **mi ya ko* would not be an accent, and so the accent of *de'su* would remain, giving the contrast

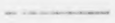
(5-6) ko/ko\ro desu 'It's a heart'

*mi/ya\ko/de\su 'It's a city'

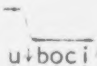
Surely a tonal system of this sort could not exist. But in order to prevent it from occurring in McCawley's theory, we must add the restriction that languages which make use of the feature [+acc] may not make lexical use of tone-level features, though in the end tone-level features play a part in the tonal systems of all languages.

Because of the difficulty of keeping the two systems apart, and because of the lack of predictive value in the distinction between pitch-accent and tone languages, I believe it to be an advantage of the dynamic-tone theory which is being proposed here that it does not require different systems of lexical representation for these two sorts of languages. In this theory, lexical tone can be represented in the same way in all languages, the only difference being that those languages which were traditionally classified as pitch-accent languages have more predictable lexical tone contours than those which were classified as tone languages. For instance, in Tokyo Japanese, a "pitch-accent" language, every word has the tone contour [...↓...]; the only question is where the ↓ will occur. Japanese differs in this respect from the "tone" language Igbo, in which, with only a few exceptions, either tone marker may occur at any syllable boundary of a word. Thus among three-syllable nouns in Igbo we find all the lexical tone contours shown below:

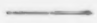
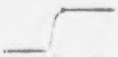
(5-7)



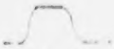
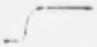
a. akwụkwọ↓ 'leaf, paper' b. uṽu↓ne↑ (a kind of fruit)



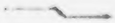
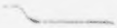
c. a↓ka↑bọ↓ 'hedgehog' d. ụ↓bọcị↑ 'day'

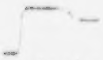
e. ŋgajị↑ f. aghị↑gha↓ 'needle'

g. ọ↑kụ↓kọ↑ h. ŋ↑kuku↓ 'cup'

i. mkpụ↓rụ↓ 'seed' j. ŋ↓ghadha↓ 'sword'



k. a↑da↓ka↓ 'chimpanzee'

Although the dynamic-tone theory itself does not make a principled distinction between pitch-accent and tone languages, we may, if we wish, continue to use these terms, making use of the theory to define them more precisely. In the remainder of this dissertation, I will use the term "pitch-accent language" to refer to a language in which (i) there are tone markers in the lexical representations of words, and (ii) there is at most one tone marker in the representation of any word whose direction and/or position is unpredictable. Although I have spoken here of pitch-accent LANGUAGES and tone LANGUAGES, there is no reason to expect that the words of a language will all have equally predictable tone contours. For example, there is nothing to prevent the occurrence of a language in which verbs have tone contours as predictable as those of a pitch-accent language, while the tone contours of nouns are less predictable, as in a tone language. Similarly, there is no reason to expect a sharp division between pitch-accent and tone languages -- rather we expect to find languages spread out over a continuum, with some languages which are tone languages by the definition which I have chosen being nevertheless very close to pitch-accent systems. In Chapter II, I will argue that Osaka Japanese is such a language.

6. Pitch-Accent in the Autosegmental Theory

Haraguchi, in his dissertation *The Tone Pattern of Japanese: An Autosegmental Theory of Tonology* (1975) gives a very careful and enlightening analysis of a large number of Japanese dialects within the autosegmental theory of tone, a level-tone theory whose distinguishing characteristic is that it makes use of autonomous tone-segments which appear on a separate level from the phonological segments. (The use of this notion in accounting for gliding tones was discussed briefly in section 4 above.)

In the versions of the autosegmental theory proposed by Haraguchi and by Goldsmith (1976), the tone-segments (on the tonological level) are mapped onto the phonological segments (on the phonological level) by means of tone-association rules which follow either of two patterns -- a non-accentual pattern, in which the tone segments are simply mapped onto the phonological segments in a one-to-one fashion from the beginning or the end of the word, or an accentual pattern, in which some designated segment of the tone melody is matched to some designated segment of the phonological string and there is a one-to-one mapping of tone segments to syllabic segments on either side of the original matching. In Haraguchi's version of the theory, a non-accentual language has either of the following tone-assignment rules, depending on whether mapping is to begin at the right-hand or the left-hand side of the word:

(6-1) a. $\begin{array}{c} V \\ \vdots \\ T \end{array} \; Q \; \#$ b. $\# \; Q \; \begin{array}{c} V \\ \vdots \\ T \end{array}$

(where Q is the longest sequence of both phonological and tonological segments, and where the structural change created by the rule is the introduction of the association line.)

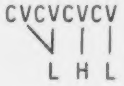
Rule (b) would establish the following association between a LHL tone melody and a four-syllable phonological string:

(6-2) $\begin{array}{cccccccc} C & V & C & V & C & V & C & V \\ & & & & & & & | \\ & & & L & & H & & L \end{array}$

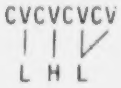
while rule (a) would produce the association

(6-3) $\begin{array}{cccccccc} C & V & C & V & C & V & C & V \\ & | & & & & & & \\ & L & & H & & L & & \end{array}$

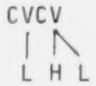
The rest of the melody is then mapped on by means of universal tone-mapping conventions which insure, roughly, that every tone-segment is matched with a tone-bearing segment, that every tone-bearing segment is matched with a tone-segment, and that tone-association lines do not cross. Stated in this simple way, the conventions do not define a unique mapping, and there is some controversy about exactly how they should be stated. I will not concern myself with this question, but will simply assume that there is some way of stating the conventions so that they will work in the desired way in every case. Thus we will assume that the universal conventions convert the structure of (6-2) to

(6-4)


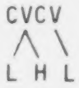
with the final tone-segment of the formula mapped onto two syllables, so that no syllable is left without an associated tone-segment. Similarly, the universal conventions apply to (6-3) in such a way as to produce

(6-5)


If there had been only two syllables in (6-2) and (6-3), then by the universal convention that every tone-segment must be mapped onto a tone-bearing segment, we would have obtained the tone-mapping

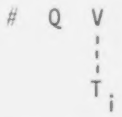
(6-6) a.


(by Rule (6-1.a))

or b.


(by Rule (6-1.b))

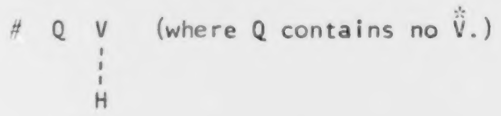
Accentual systems differ from non-accentual systems in this theory in that they make use of the device of a "starred syllable" in their tone-association rules. In Haraguchi's version of the theory,[10] the tone-mapping rule of an accentual language looks like this:

(6-7)


(Where Q contains no $\overset{*}{V}$.)

Here some designated segment of the tone melody is associated with a designated (starred) syllable of the phonological string and the universal mapping conventions then map on the rest of the tone melody in the same way as in a non-accentual system. For example, Haraguchi suggests that Tokyo Japanese has the basic tone melody HL, and that this melody is mapped into words by means of the tone-association rule

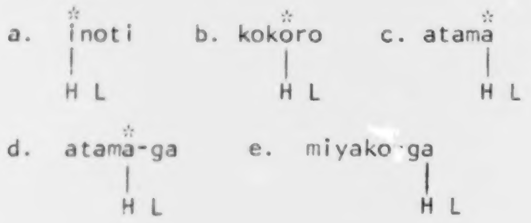
(6-8)



# Q V
H
(where Q contains no $\overset{*}{V}$.)

Given the nouns $\overset{*}{i}noti$ 'life', $kok\overset{*}{o}ro$ 'heart', $atam\overset{*}{a}$ 'head', *atama-ga* 'head' + nominative marker, and *miyako-ga* 'city' + nominative marker, the tone-association rule produces the following associations:

(6-9)

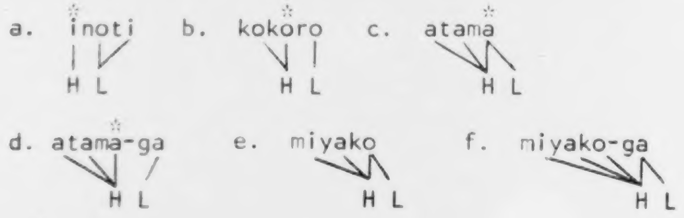


a. inoti
H L
b. kokoro
H L
c. atama
H L
d. atama-ga
H L
e. miyako-ga
H L

(Notice that where the word is unaccented, as in (e) the tone-association rule associates the high tone with the final syllable of the string.)

The universal tone-mapping conventions then apply to give the completed mappings:

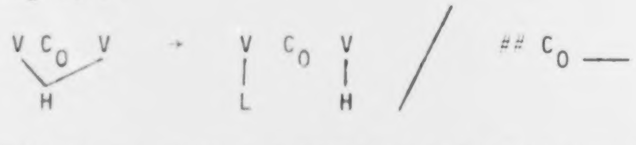
(6-10)



a. inoti
H L
b. kokoro
H L
c. atama
H L
d. atama-ga
H L
e. miyako
H L
f. miyako-ga
H L

Two additional rules are necessary to obtain the correct surface forms from the underlying forms of (6-10). First there is an Initial Lowering Rule:

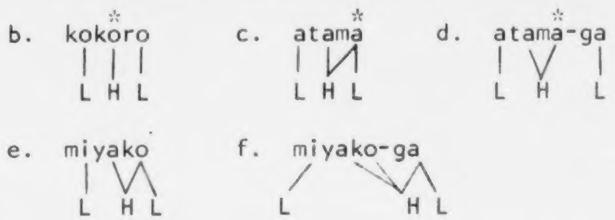
(6-11)



V C0 V
H
→
V C0 V
L H
/
## C0 ___

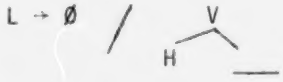
This rule introduces a low tone-segment at the beginning of a word, mapping it onto the first syllable, and simultaneously erasing the association which will have been established by the tone-mapping process between that syllable and the high tone-segment of the basic tone melody. Rule (6-11) applies to all the forms of (6-10) except (a), changing them to the following:

(6-12)



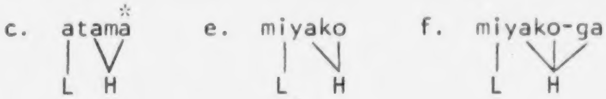
Finally, the Tone Simplification Rule[11]

(6-13)



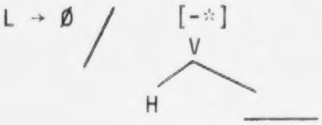
applies to forms (c), (e), and (f), simplifying their final gliding tones and creating the correct surface output,

(6-14)



For those speakers who retain the falling glide at the end of final-accented nouns like *atama*, the tone-simplification rule is stated in the following way,

(6-15)



so that it applies only to words like *miyako* and *miyako-ga*, whose final syllables are not marked with a star.

In summary, Haraguchi proposes that in Tokyo Japanese a noun has at most one "starred" syllable in its lexical representation, and that the basic tone-melody HL is mapped on by a rule which assigns the high tone to the last vowel which is not preceded by a starred vowel. Thus, when the word has a starred syllable, the high tone is assigned to it, and when there is no starred syllable, the high tone is assigned to the last syllable of the word. A rule of Initial Lowering accounts for the low tone of the first syllable of most words, and the gliding tone which arises at the end of the word when the high tone is associated with the final syllable of the word is eliminated by a tone-simplification rule which deletes the low tone of the tone-melody. Some speakers apply this rule only to unaccented words.

Haraguchi also provides rules to account for the tonal properties of adjectives and verbs, in which the position of the star is determined by rule. I will not discuss those here, however, since his analysis of nouns is sufficient to give the flavor of the analysis and to allow us to compare it with the analyses which have been given of these same facts in other theories.

Looking at the theory from a broader perspective, we see that the autosegmental theory, like McCawley's theory, makes a fundamental distinction between the way in which lexical tone is represented in a pitch-accent language and the way in which it is represented in a true tone language. In a tone language like Igbo, each lexical item is assigned a feature of some kind which indicates which of several possible tone melodies (e.g. L, H, LH, HL, LHL, HLH, etc.) is to be mapped into that item. The tone-mapping rule is of the form shown in (6-1); that is, it maps the first tone of the tone melody onto the first syllable of the word (or, alternatively, the last tone of the tone melody onto the last syllable of the word), and the rest of the tone melody is distributed accordingly.

In pitch-accent languages like Japanese, on the other hand, the tone-mapping rule looks like this:

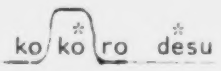
$$(6\text{-}16)\quad \begin{array}{ccc} \# & Q & V \\ & & \vdots \\ & & T_i \end{array} \qquad \text{or} \qquad \begin{array}{ccc} V & Q & \# \\ \vdots & & \\ T_i & & \end{array}$$

$$\text{(where } Q \text{ contains no } \overset{*}{V}\text{)}$$

and a lexical item may be marked with a star on one of its tone-bearing units as well as with a feature indicating which of the tone melodies of that language is to be mapped onto it. (In Tokyo Japanese there is just one tone melody, HL, but there are pitch-accent languages which have more than one. For example, the Osaka Dialect of Japanese has the two tone melodies HL and LHL, so that we find *ka/bu\to* 'helmet', contrasting with *oto\ko* 'man'. See Haraguchi (1975) and the discussion of Osaka Japanese in Chapter 11.)

The autosegmental theory successfully avoids the problem which we observed in McCawley's theory of keeping the two tonal systems separate from one another. Thus the existence of unstarred words in pitch-accent languages is no problem, because the tone-assignment rules for pitch-accent languages apply to unstarred words as well as to starred ones.[12] The intrusion of starred words into tone languages is also not a problem, because the presence of such a word would have no consequences; the tone-association process in a tone language is not affected by the presence of a star. In addition, the autosegmental analysis has the advantage eliminating the need for at least some kinds of "accent-reduction" rules because, for example, the tone-mapping rule itself accounts for the fact that only the first accent of a phrase such as *kok$\overset{*}{o}$ro d$\overset{*}{e}$su* is realized in the surface form:

(6-17)



'It's a heart.'

Despite these advantages, the autosegmental theory has serious flaws which, I believe, make it inadequate as a theory of tone for human languages. These flaws will be discussed in the following section.

7. Some Arguments Against the Autosegmental Theory

In this section I will present several arguments against the autosegmental theory of tone, beginning with the most general, and ending with a discussion of certain specific phenomena of Japanese for which it fails to provide an adequate account.

7.1 Concerning the distinction between pitch-accent languages and tone languages. Although the distinction between pitch-accent languages and true tone languages plays a fundamental role in the autosegmental theory in that it determines which of two systems of tone mapping is to be chosen for a given language, the theory as it has been presented in published work does not provide adequate criteria for deciding in every case which sort of system a language has. For example, consider the following data from Etung, taken originally from Edmundson and Bendor-Samuel (1966) and brought to my attention by Goldsmith (1976):

(7.1-1)

Tone pattern	1-syll word	2-syll word	3-syll word
a. L	kpè 'even'	ǹjòm 'juju'	èyǜrì 'dress'
b. LH	kǎ 'to'	ǹsí 'fish'	bìsóné 'spoon'
c. HL	tîk (future)	égòm 'jaundice'	ákpùgà 'money'
d. H	kpá 'first'	gbán 'servant'	ŋ́kímí 'prosecutor'
e. LHL	--	òbô 'arm'	m̀bútà 'rein'
f. LLH	--	ǹsǐ 'mud'	òròbé 'beam'
g. HHL	--	éfô 'cloth'	ŋ́gárà 'pepper'
h. HLH	--	ábǒ 'they'	édìmbá 'pot'

If we assume that a falling-rising or rising-falling glide is not possible on a single tone-bearing unit (hence the gaps in (e) and (h), above), Etung has almost every possible tone shape of one, two, or three syllable words. The only exception is in the distribution of gliding tones, which are found almost exclusively at the ends of two- and three-syllable words. Gliding tones never occur word-internally, and only rarely at the ends of three-syllable words. I will return to this point in Chapter V.

With tone contours so unpredictable, Etung is, one would think, a paradigm example of a non-accentual language, which should be analyzed in the autosegmental system as having the tone melodies L, LH, HL, H, LHL, LLH, HHL, and HLH, and the non-accentual tone-association rule of (6-1.a), repeated below as (7.1-2):

(7.1-2) $\begin{array}{ccc} V & Q & \# \\ \vdots & & \\ T & & \end{array}$ (where Q is the maximal sequence of both tonological and phonological segments)

However, this language is also subject to analysis as an accentual system, with the tone melodies HLH, HL, and LH, the tone-association rule

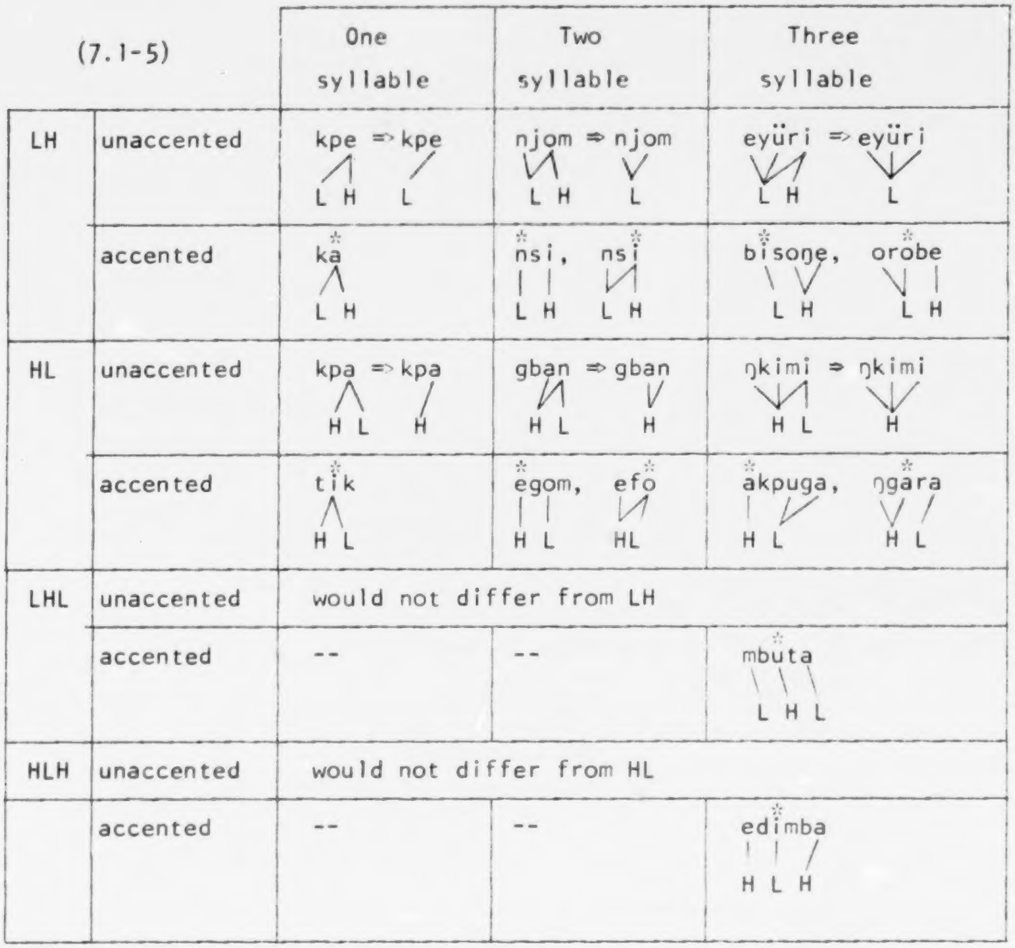
(7.1-3) $\begin{array}{cccc} \# & Q & V & \\ & & \vdots & \\ & (T) & T & T \end{array}$ (where Q does not contain any $\overset{*}{V}$)

and the tone-simplification rule

(7.1-4) $T \rightarrow \emptyset \; / \; \begin{array}{c} [-*] \\ V \\ \diagup \quad \diagdown \\ T \quad \underline{\qquad} \end{array}$

In this analysis, the words of (7.1-1) would be derived in the following ways:

(7.1-5)



		One syllable	Two syllable	Three syllable
LH	unaccented	kpe ⇒ kpe L H L	njom ⇒ njom L H L	eyüri ⇒ eyüri L H L
	accented	k$\overset{*}{a}$ L H	$\overset{*}{n}$si, ns$\overset{*}{i}$ L H L H	b$\overset{*}{i}$soŋe, or$\overset{*}{o}$be L H L H
HL	unaccented	kpa ⇒ kpa H L H	gban ⇒ gban H L H	ŋkimi ⇒ ŋkimi H L H
	accented	t$\overset{*}{i}$k H L	$\overset{*}{e}$gom, ef$\overset{*}{o}$ H L HL	$\overset{*}{a}$kpuga, ŋg$\overset{*}{a}$ra H L H L
LHL	unaccented	would not differ from LH		
	accented	--	--	mb$\overset{*}{u}$ta L H L
HLH	unaccented	would not differ from HL		
	accented	--	--	ed$\overset{*}{i}$mba H L H

The autosegmental theory as it has been developed up to now does not provide criteria for deciding between these competing analyses, nor does the Evaluation Metric tell us how to choose between the accentual analysis, with four tone melodies, one tone rule, and a lexical constraint, and the non-accentual analysis, with eight tone melodies, no tone rule, and no lexical constraint.

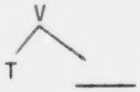
Goldsmith (1976) notices that an accentual analysis of Etung would be possible (though he doesn't notice that the number of tone melodies could thereby be cut in half) and asks the question, "How does a language learner decide if the language is accentual or not?" He considers the possibility that a pitch-accent language should be limited, in principle, to just one neutral tone melody, but rejects this solution on the grounds that both he and Haraguchi have proposed accentual analyses for languages with more than one neutral tone melody. There is also a more fundamental objection to this solution, in that it introduces a characteristic property of pitch-accent languages -- the property of having only one basic tone melody -- which cannot be derived in any principled way from the fundamental pitch-accent property of having a tone-association rule of the form of (6-16). For this reason, I believe that Goldsmith was correct to reject his tentative answer to the question of what makes a language accentual. Nevertheless, the lack of an answer to this question leaves the autosegmental theory in a weak position, for the analysis of the tonal systems of a great many languages is thereby left indeterminate. The elimination of this indeterminacy is made more difficult by the fact that languages with complex and unpredictable lexical tone contours have often been analyzed as accentual systems within the autosegmental theory. See, for example, Goldsmith's analyses of Tonga and Lomongo ((1976), pp. 142-148 and 30-33) and Leben's (1977) analysis of Mende, which treats Mende as a "mixed" accentual-nonaccentual system.

7.2 Concerning the analysis of tonal phenomena within accentual systems. In the preceding section I argued that although it makes crucial use of the distinction between pitch accent languages and tone languages, the autosegmental theory fails to provide adequate criteria for determining which of these categories a given language belongs to. In this section I will show that the theory also does not provide a way of choosing among the multiple analyses which it makes available for particular tonal phenomena within languages which are clearly of the accentual type. The problem arises from the fact that the autosegmental theory, in dealing with accentual languages, makes use of three layers of tonal structure: the starred syllable, the tone melody, and the associations between tone segments and phonological segments. The result is that there are a great many logically possible ways of accounting for any departure from the expected tonal output. Thus one might propose (i) a rule inserting, deleting, or moving a *, (ii) a rule inserting, deleting, or changing the nature of a tone segment, (iii) a rule associating a tone segment with a phonological segment or de-associating a tone-segment from a phonological segment, or (iv) a rule transposing two tone segments with each other.

Certainly one would hope that not all these kinds of rules would be necessary in analyses of actual languages within the autosegmental theory, and that constraints might be added to the system to exclude some of them. However, Haraguchi, although he had hoped to find "interesting constraints on possible tone alternation rules", was in fact unable to do so; in his analyses of the various Japanese dialects he makes use of all the types of rules listed above except (iv).

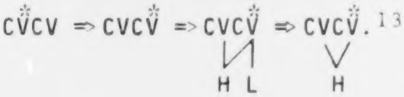
With such a variety of possible tone rules, the theory fails to provide a unique "best" analysis -- or even to narrow the choice very much -- in a great many cases. For example, suppose that in a language with a HL basic tone melody, the tone-association rule of standard Japanese, and a tone-simplification rule of the form

(7.2-1) T → Ø /



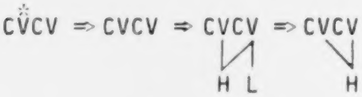
it were to turn out that in certain circumstances bisyllabic nouns with starred first syllables had the tone shape $\overline{CVCV}$ instead of the expected $\overline{CV}\underline{CV}$. There are at least seven possible analyses of these facts in the autosegmental theory:

(7.2-2) a. There is a star-shift rule which moves the star from the first syllable to the second, so that we get

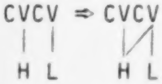


[13]

b. There is a star-deletion rule which deletes the star altogether, so that we get

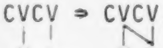


c. There is a rule of the form



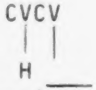
which applies after tone-mapping, and rule (7.2-1) then deletes the low tone-segment.

d. There is a rule of the form



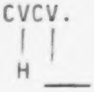
, and rule (7.2-1) deletes the low tone segment. By the universal tone-mapping conventions, the high tone-segment is then associated with the now toneless second syllable.

e. There is a rule of the form L ⇒ Ø /

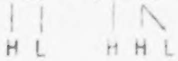


and the universal tone-mapping conventions apply as in (d).

f. There is a rule changing a low tone segment to a high tone segment in the environment CVCV.



g. There is a tone-insertion rule of the form CVCV ⇒ CVCV, and rule (7.2-1) deletes the L.

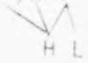


The difficulty here is not simply that there are many alternative analyses of the same phenomenon. What is more important is the fact that neither the Evaluation Metric nor the theory itself provides criteria for choosing between the alternatives. We have no way to determine which is more "complex" -- a star-movement rule, a star-deletion rule, a re-association rule (leftward or rightward), a tone-deletion rule, a tone-substitution rule, or a tone-insertion rule. Thus we are led to the implausible conclusion that a child learning the language has to sort through seven possible analyses of the data, choosing among them only on the basis of which fits most neatly into the grammar of the remainder of the tonal system, the analysis of that remainder being, presumably, no more easily determined than the analysis of this part.

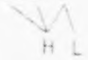
The dynamic-tone theory, in contrast, does not require us to choose among multiple analyses of every tonal phenomenon. In particular, the dynamic-tone theory allows only one simple analysis of the facts described above: there is a rule deleting the ↓ of the underlying form CV↓CV. This difference in the number of available analyses is a result of the fact that there is only one level of tonal structure to be manipulated in the dynamic-tone theory -- the tone markers. Thus the difference in number of analyses in this case is not a fact about this particular set of data, but can be expected to obtain for a great many tonal phenomena.

7.3 Concerning the distinction between unaccented words and final-accented words in Japanese. Recall that the autosegmental tone-association rule for Tokyo Japanese creates identical tone mappings for unaccented and final-accented nouns such as

(7.3-1) a. miyako 'city' (unaccented)



b. ?atama* 'head' (final-accented)



For some speakers of Tokyo Japanese, these two classes of words have identical tone shapes in isolation; that is, they are pronounced

(7.3-2) a. mi yako

b. ?a tama

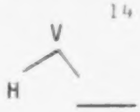
Speakers of this dialect differentiate between the two classes of nouns only when they are followed by other material within the phrase:

(7.3-3) a. mi yako ga

b. ?a tam$\overset{*}{a}$ ga

Haraguchi proposes that speakers who use the pronunciation given in (7.3-2) have the tone-simplification rule

(7.3-4) L → Ø / [14]



This rule deletes the low tone of the HL tone melody when it and the high tone have both been assigned to the final syllable of word.

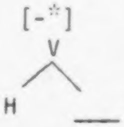
However, recall that there are also speakers who distinguish between unaccented and final-accented nouns even in isolation. Instead of the pronunciation given in (7.3-2), these speakers have the pronunciation

(7.3-5) a. mi yako

b. ?a tam$\overset{*}{a}$

For these speakers, Haraguchi proposes a tone-simplification rule of the form

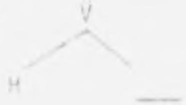
(7.3-6) L → Ø /



This rule simplifies the gliding tone just in case it is associated with an unstarred vowel; that is, it simplifies the gliding tone at the end of (7.3-1.a) but not at the end of (7.3-1.b).

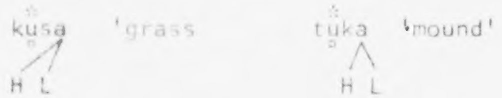
What is unsatisfactory about this analysis is that it treats the distribution of the falling glide in (7.3-5) as a mere accident. Thus, in this system it would be as easy to write a tone-simplification rule of the form

(7.3-7) L → Ø /



as it is to write the existing rule (7.3-6). In a dialect with rule (7.3-7), the UNaccented nouns would be pronounced in isolation with a falling glide on the final syllable, and the accented nouns would not. In this hypothetical dialect, then, words which had a fall in pitch at the end when followed by a particle like *ga* would not have one in isolation, while those which had a fall in pitch at the end in their isolation forms would have none when followed by a particle. No such dialect occurs among the dialects of Japanese described by Haraguchi, though there are many dialects with the tone simplification rule of (7.3-6); nor does it seem likely that such a dialect could occur. However, it is not at all clear how to exclude it within the autosegmental theory. One could, perhaps, set up markedness conditions for rules of the tone-simplification type, whereby rules like (7.3-4), which simplify ALL gliding tones and rules like (7.3-6), which simplify gliding tones on unstarred syllables only, would be permitted, while rules like (7.3-7), which simplify only those gliding tones which are associated with starred syllables, would be highly marked or excluded altogether. There are two problems with this solution, however. First, in languages like Japanese, where the "starred" syllable is neither longer nor more heavily stressed than other syllables, there is no obvious reason why it should be more natural for a starred syllable to carry a gliding tone than for an unstarred syllable to do so. In addition, there are facts which suggest that it is the unaccentedness of the WORD rather than of the final syllable itself which causes it never to end with a fall in pitch. For example, in the Osaka dialect, which has the tone-simplification rule of (7.3-6), the final gliding tone is not simplified in nouns like

(7.3-8)

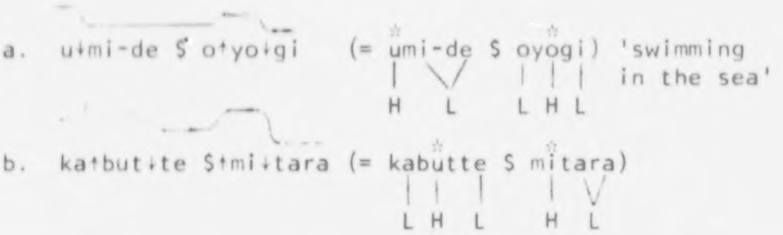


In Haraguchi's analysis, the tone representations above arise when the starred vowel of the word is de-voiced, so that it is no longer capable of bearing a tone. In such a case, the high tone of the basic tone melody is automatically disassociated from the de-voiced syllable, and, by the universal tone-association conventions, is then associated with the still tonally-viable second syllable. Haraguchi uses rule ordering to account for the fact that the tone-simplification rule does not apply in cases like these, but one feels, I think, that there is a deeper reason, namely, that these are ACCENTED nouns. In other words, the generalization is that accented nouns have pitch drops and unaccented ones do not; the nature of the particular syllable with which the drop is associated is irrelevant.

In conclusion, I have argued here that the autosegmental theory is ill-equipped to deal with the differences in tonal behavior between final-accented nouns like *ʔatama↓* and unaccented nouns like *miyako*. In particular, the autosegmental theory would not exclude, or even mark as odd, a dialect of Japanese in which unaccented words had final "accents" in isolation, while accented words did not. This is in contrast to the dynamic-tone theory, which predicts (correctly, I believe) that such a dialect of Japanese could not occur. That is because this dialect would have to include a rule which deleted the final ↓ of *ʔatama↓* when it came at the end of a phrase, while simultaneously inserting a ↓ at the end of *miyako* in the same environment. Given constraints which we will want to impose on phonological rules in general, it will not be possible for a language to contain such a tonal process.

7.4 Concerning downdrift in Tokyo Japanese. When two word-level phrases, each with its own ...↑...↓... tone contour, are joined together in deliberate speech in Japanese, the result is something like the following:

(7.4-1)


a. u↓mi-de $ o↑yo↓gi (= umi-de $ oyogi) 'swimming in the sea'
H L L H L
b. ka↑but↓te $↑mi↓tara (= kabutte $ mitara)
L H L H L

'If I were to try putting on (a hat)'

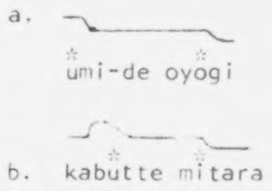
(the symbol "$" between the words of these examples signifies that each word is a separate phrase, with a pause or lengthening of some sort between them.)

Notice that there is a lowering of pitch between successsive high tones in the examples of (7.4-1). In Japanese, as in many other languages, high tones separated by an intervening low do not maintain the same pitch level; instead, each high-toned sequence is a little lower than the preceding one. The same is true of low-toned sequences separated by high. This gradual lowering of pitch levels, known as "downdrift", is presumably the result of a decrease in subglottal pressure throughout the breath group. However, the lowering of pitch level does not proceed steadily throughout the breath group, but instead takes place in spurts, whenever a change is made from high to low or from low to high.

Within a dynamic-tone theory, the occurrence of downdrift is most easily accounted for by means of a convention which makes a pitch rise at any point within the breath group a little smaller than a pitch drop would be at that same point. If each pitch rise of the contour is a little smaller than the pitch drop which preceded it, the result will be an overall lowering of the pitch register of the voice throughout the breath group. Within a level-tone theory, downdrift is best accounted for by means of a convention which lowers the high and low pitch registers whenever unlike tones succeed one another.

Now consider what happens when the phrases of (7.4-1) are pronounced at normal conversational speed, as a single intonation phrase. In this case, according to Haraguchi, we find the tone contours

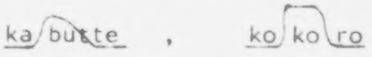
(7.4-2) a.



with no pitch rise at the beginning of the second word of the phrase.

Haraguchi accounts for the tone contours of (7.4-2) in the following way: First, he proposes that the rule of Initial Syllable Lowering (6-11), which lowers the first syllable of the word in

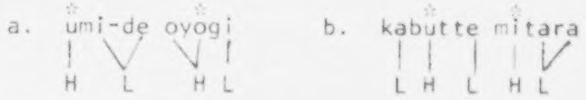
(7.4-3)



, etc.

should apply only after a pause (i.e., only at the beginning of a phrase), and not at the beginning of every word. Thus, this rule does not apply to *oyogi* and *mitara* in (7.4-2), and these phrases have the tone representation

(7.4-4)



However, the tone representations of (7.4-4) do not, by themselves, account for the conversational-speed pronunciation of these phrases, but must be combined with a special downdrift convention which Haraguchi states as follows:

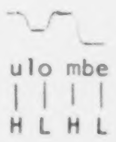
(7.4-5) H-L-H-L => H-L-L-lowered L

The downdrift convention of (7.4-5) converts the tone representations of (7.4-4) to the pitch contours of (7.4-2). This downdrift convention could be stated more elegantly (following Goldsmith) as

(7.4-6) The high pitch register is lowered to the level of the low pitch register whenever a high tone segment is immediately preceded by a HL-sequence within the same phrase.

Nevertheless, the convention is not a very nice one at best, and, what is more, it is language-specific. For example, a HL##HL sequence in Igbo does not have the tone contour of (7.4-2.a), but rather that shown below:

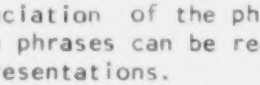
(7.4-7)



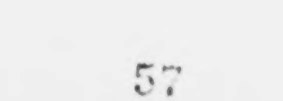
'the house of a tortoise'

For this reason, it is a significant advantage of the dynamic-tone theory that it can account for the facts of (7.4-2) without a special convention of any kind. In the dynamic-tone theory, the restriction of the rule of Initial Syllable Lowering (=Pitch Rise Insertion (2-6)) to the beginning of a phrase is sufficient by itself to account for the tone contours of (7.4-2), for if the rule of Pitch Rise Insertion does not apply to *oyo↓gi* and *mi↓tara* in these phrases, then the tone representation of the phrases is as follows

(7.4-8) a.



b.



with a sequence of pitch drops in each representation, just as in the actual pronunciation of the phrase. Thus the surface pitch contours of these phrases can be read off directly from their dynamic-tone representations.

8. On Some Other Tonal Systems of the Pitch-Accent Type

8.1 Serbo-Croatian. In section 5, I proposed to use the term "pitch-accent language" to refer to a language with lexical tone such that there is at most one unpredictable tone marker in the lexical representation of a word. By these criteria, Tokyo Japanese is a pitch accent language whose unpredictable tone marker (I will call this unpredictable tone marker the "basic" tone marker) is a ↓. However, there is no obvious reason why the basic tone marker of a pitch-accent language should have to be a ↓, and so we may expect to find languages in which it is a ↑. A particularly elegant analysis of the tonal properties of Serbo-Croatian stems and how they determine the tone contours of the words in which they appear may be obtained by assuming that Serbo-Croatian is a pitch-accent language whose basic tone marker is a ↑.

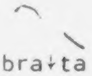
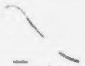
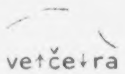
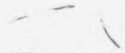
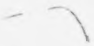
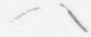
Let us assume that a Serbo-Croatian stem, in lexical representation, contains at most one tone marker, and that that tone marker is always a ↑. The examples below show that the ↑ may occur at any point within the stem, or may not occur at all:

(8.1-1)	a.	Stem-initial[15]	
		↑brat-	'brother'
		↑sūnc-	'sun'
	b.	Stem-medial	
		ve↑čer-	'supper'
		nā↑rod-	'people'
	c.	Stem-final	
		sestr↑-	'sister'
		rūk↑-	'hand'
	d.	No ↑.	
		vod-	'water'
		pūtnik-	'traveler'

(A line over the top of a vowel indicates that the vowel is long.)

Having assumed these lexical representations for the stems themselves, we have no difficulty in predicting the tone contours of the words in which they appear. Every word of Serbo-Croatian has the tone shape [...↑σ↓...], with the ↑ of the stem, if there is one, serving as the ↑ of the word. Thus the stems of (8.1-1.a)-(8.1-1.b) form words with the tone contours shown below:

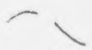
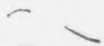
(8.1-2)

STEM	WORD FORMED FROM THAT STEM
↑brat-	 ↑bra↓ta
↑sūnc-	 ↑sūn↓ce 'sun' (acc. sing.)
ve↑čer-	 ve↑če↓ra 'supper' (nom. sing.)
nā↑rod-	 nā↑ro↓da 'people' (gen. sing.)
sestr↑-	 ses↑tra↓ 'sister' (nom. sing.)
rūk↑-	 rū↑ka↓ 'hand' (nom. sing.)

I have placed the tone markers in the representations above at what I take to be the syllable boundaries. I assume that the final consonants of stems like *sestr*↑- and *rūk*↑- join together with the suffix vowel to form a single syllable, so that the position of the ↑ must be adjusted to conform to the well-formedness condition that tone markers occur only at the boundaries of tone-bearing units. What happens in cases like this will be discussed in some detail in Chapter V.

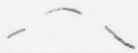
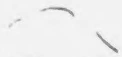
Words formed from unaccented stems such as those given in (8.1-1.d) have their ↑ at the beginning of the word, as shown in the examples below:

(8.1-3)

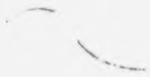
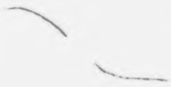
STEM	WORD FORMED FROM THAT STEM
vod-	 ↑vo↓du 'water' (acc. sg.)
pūtnik-	 ↑pūt↓nik 'traveller' (nom. sg.)

As long as the stem is in initial position in the word, words of this class have the same tone contour as words formed from initially-accented stems. However, the two tone classes differ when combined with cliticizing prepositions, as in the following examples:

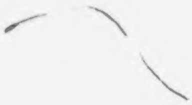
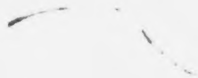
(8.1-4)

STEM	WORD FORMED FROM THAT STEM
brat-	 od↑bra↓ta 'from brother'
med-	 od↑me↓da 'from honey'

The reader will probably have observed that in all the examples given above, the first internal tone marker of the word is pronounced as a gliding tone on the syllable which precedes it. Thus, words with the representation [↑σ↓...] have the tone contour

(8.1-5)  or 

depending on whether the syllable preceding the ↓ is long or short, and words with the representation [...σ↑σ↓...] have the tone contour

(8.1-6)  or 

The fact that the first internal tone marker is realized at least partly as a gliding tone on the syllable which precedes it may be accounted for by means of the convention that a tone marker which follows a long syllable is realized as a gliding tone on that syllable. That is because the syllable which precedes the first internal tone marker of a Serbo-Croatian word is always stressed and lengthened to some degree. In other words, a word always has one of the following stress-tone patterns, where the stressed syllable is marked with a "/":

(8.1-7) a. [...σ́↑σ↓...] (e.g. nā́↑ro↓da)

b. [↑σ́↓...] (e.g. ↑vó↓du)

Words with the stress-tone pattern of (a) have rising pitch on the stressed syllable, and are therefore said to have "rising accent", while those with the stress-tone pattern of (b) have falling pitch on the stressed syllable and are said to have "falling accent." Though all stressed syllables are lengthened in Serbo-Croatian, underlying length is preserved under stress, according to Lehiste. While a short stressed vowel has the same duration as an unstressed long one, a stressed long vowel is longer still, and that difference in length is reflected in how completely the following tone marker is realized during the stressed syllable. For example, in the word *ná↑ro↓da* 'people' (gen. sg.), which has long rising accent, the entire pitch rise has been completed by the end of the syllable *na*, but in the word *vé↑če↓ra* 'supper' (nom. sg.), which has short rising accent, the pitch rise continues into the following syllable.

The analysis which has been outlined informally above may be stated formally as follows:

(8.1-8) The Lexical Tone Contours of Stems

In a stem of the form $[\underset{1}{\ldots}\underset{2}{[+\text{tone}]}\underset{3}{\ldots}]$, 2 is a ↑

and 1 and 3 contain no tone markers.

The condition above insures that a stem will contain at most one ↑ and no ↓'s.

(8.1-9) The Lexical Tone Contours of Words

a. In a word of the form $[\underset{1}{\ldots}\underset{2}{\uparrow}\underset{3}{\ldots}]$, 3 = $\underset{4}{\sigma}\underset{5}{\downarrow}\underset{6}{\ldots}$, and

1 and 6 contain no tone markers.

b. In a word of the form $[\underset{1}{[+\text{unit}]}\underset{2}{\ldots}]$[16], if 2 contains no ↑, then 1 is a ↑.

Condition (a) above insures that there is a ↓ one syllable after the ↑ in every word of Serbo-Croatian, and condition (b) insures that there will be a ↑ at the beginning of the word if there is none inside it (as in words formed from toneless stems like *vod-* 'water'). These two conditions together predict the tone contour of a word on the basis of whether or not there is a morphologically assigned ↑ in the stem of the word, and if so, where it is located.

(8.1-10) Lexical Stress

In a word of the form $[\underset{1}{\ldots}\underset{2}{\sigma}\underset{3}{[+\text{tone}]}\underset{4}{Q}]$, where Q is the maximal string of units, 2 is stressed, and 1 and 4 contain no stressed syllables.

The lexical structure condition above places stress on the first syllable of the word which is followed by a tone-change. In other words, in a word with the tone shape [...σ↑σ↓...], it assigns stress to the syllable before the ↑, producing a "rising accent", and in a word with the tone shape [↑σ↑...], it assigns stress to the syllable before the ↓, producing a "falling accent".

The advantage of the dynamic-tone analysis of Serbo-Croatian which is presented above is that it allows the tone contours of all words to be derived from the lexical representations of their stems. This is in contrast to an autosegmental level-tone analysis in which Serbo-Croatian would, presumably, be said to have the lexical tone melody MHL and the tone-association rule

(8.1-11) $\begin{array}{c}\overset{\star}{V}\\ \vdots\\ H\end{array}$ P #, where P does not contain $\overset{\star}{V}$.

Under this analysis, stems of the class of *brat-* 'brother' would be represented lexically as *br*$\overset{\star}{\text{ȃ}}$*t-*, those like *nā↑rod-* 'person' would be represented as *nar*$\overset{\star}{\text{ȍ}}$*d-*, and those like *vod-* 'water' would have no star. But there is no simple way, in this system, to represent stems like *ruk↑-*, which have the property of assigning the high tone of the tone melody to the FOLLOWING SYLLABLE. Presumably stems of this class must be marked with a diacritic feature which makes them subject to a rule assigning a star to the first vowel which follows the stem.[17]

8.2 Mende. Tokyo Japanese and Serbo-Croatian are examples of languages of the pitch-accent type in which the direction of the morphologically assigned tone marker of a lexical item is fixed; in Tokyo Japanese it is a ↓, and in Serbo-Croatian it is a ↑. However, the theory does not in any way require that a language which provides for only one unpredictable tone marker per word must prescribe the DIRECTION of that tone marker. Thus it should be possible to find languages which allow at most one unpredictable tone marker per lexical item, but in which the direction of that tone marker is not fixed. Mende, a language of Sierra Leone, appears to be such a language.

According to Leben (1973), monomorphemic words in Mende may have any of the tone melodies exemplified below:

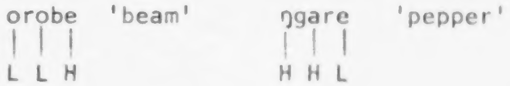
(8.2-1)

	three-syllable	two-syllable	one-syllable
a. H	lavale \\/ H	pɛlɛ \\/ H	kɔ / H
b. L	?	bɛlɛ \\/ L	kpa | L
c. HL	gɔmɛnti | \\/ H L	kenya | / H L	mbu /\\ H L
d. LH	?	navo | | L H	mba /\\ L H
e. LHL	nikili | | | L H L	nyaha | |\\ L H L	—[18]
f. LLH	mahawu | | | L L H	nika[19] | |\\ L L H	—

What Leben observed about this lexicon is that there are no occurrences of the tone melodies HLH and HHL, whether on one-syllable, two-syllable, or three-syllable words. While a fact of this sort would be very difficult to state within a segmental theory of tone like that proposed by Woo, in which tone is represented by means of features on sonorant segments, it is clearly representable in an autosegmental theory of the sort employed by Leben, for in this theory the tone melodies of the language are assumed to exist as independent lexical entities which are mapped onto the phonological representations of words in a one-tone-per-one-syllable fashion beginning from the beginning of the word. The fact that the HLH and HHL melodies do not occur at all may thus be expressed by simply omitting these melodies from the list of possible lexical tone melodies for the language.

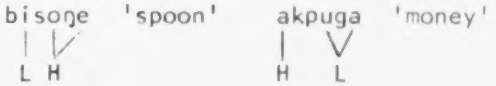
With regard to the HHL melody, Leben tries to go further than this and to suggest that such melodies are impossible in principle in any language. In order to exclude such melodies he proposes a principle called the "Obligatory Contour Principle", which states that adjacent underlying tonemes must be distinct. Goldsmith (1976) has argued against the Obligatory Contour Principle on the grounds that Etung has words like

(8.2-2)



which must be assumed to have the basic tone melodies LLH and HHL, in contrast to words like

(8.2-3)



which have the tone melodies LH and HL respectively. In fact, there is a counterexample to the Obligatory Contour Principle in Mende itself, for, as Leben points out, there are a number of words in Mende with the tone shape LLH.

On the other hand, it is not clear that there is NO principled way to exclude the tone melodies HHL and HLH from Mende within the autosegmental theory. For example, one could claim that any language draws its tone melodies from a tone formula $T_1 \ldots T_n$, any subset of which (preserving the sequence) may serve as a tone melody. Using the tone formula LLHL for Mende, we derive the actually-occurring tone melodies L, LLH, LHL, LH, HL, L, and H, but not the non-occurring HHL and HLH. (We also derive the non-occurring melodies LL and LLHL, but the first of these can be assumed to simplify to L, and the second can be excluded by a constraint that a tone melody of Mende may not contain more than three tone segments.)[20]

The dynamic-tone theory which I am proposing here also provides a simple and principled way of stating the restrictions on lexical tone in Mende. Let me begin by considering how the lexical tone shapes of (8.2-1) are to be represented in dynamic-tone terms. First of all, the falling glide on the final syllable of a word like $\underset{\text{L HL}}{\textit{nyaha}}$ (8.2-1.c) must be represented by means of a ↓ at the end of the word, coupled with a convention that a tone marker at the end of a word in Mende is realized as a gliding tone on the final syllable of the word. (Presumably the final syllable of a word is lengthened somewhat to make this realization possible.) The gliding tones on the monosyllabic items $\underset{\text{HL}}{\textit{mbu}}$ and $\underset{\text{LH}}{\textit{mba}}$ may be analyzed in the same way; that is, these gliding tones arise from the fact that there are tone markers (a ↓ and a ↑, respectively) at the ends of these words.

Now consider the monosyllabic items *kɔ* (H) and *kpa* (L). Clearly we cannot use tone markers at the ends of these words to distinguish their tone levels, because we have had to assume that a tone marker at the end of a word is realized as a gliding tone on the preceding syllable. Let us therefore use a tone marker at the beginning of a word to indicate the pitch height on which it begins; specifically, let us represent *kɔ* (H) as *↑kɔ* and *kpa* (L) as *↓kpa*. This treatment depends, of course, on the assumption that phrase-initial tone markers are not pronounced as gliding tones in Mende.

We have now determined that a gliding tone on the final syllable of a word in Mende is to be represented by means of a tone marker at the end of the word, while a tone marker at the beginning of the word indicates the tone level on which it begins. Using tone markers at the appropriate syllable boundaries to represent tone changes within the word, we obtain the following tone representations for the words of (8.2-1):

(8.2-4)

Leben's tone Melody	three-syll. words	two-syll. words	one-syll. words
H	↑lavale	↑pɛlɛ	↑kɔ
L	?	↓bɛlɛ	↓kpa
HL	↑go↓menti	↑ke↓nya	↑mbu↓
LH	?	↓na↑vo	↓mba↑
LHL	↓ni↑ki↓li	↓nya↑ha↓	___
LLH	↓maha↑wu	↓nika↑	___

Having decided on the representations for the lexical tone contours of Mende, we are now in a position to observe regularities and to account for the absence of the HHL and HLH contours. The fundamental observation to be made about these tone contours is that once the position and direction of the last tone marker of the word are known, the rest of the tone contour is predictable. In particular, a word in Mende must conform to the following lexical structure conditions:

```
(8.2-5)  a.  Every word has the tone shape [(↓...)(↑σ)[+tone]...]
                                             1 2   34     5    6
             where 2 and 6 contain no tone markers.*

         b.  In a word of the form [...[+tone]...[+tone]...],
                                     1    2     3    4     5
             where 3 contains no tone markers, 2≠4.
```

The first condition above insures that every Mende word contains a "basic" tone marker, which is the last tone marker of the word. That basic tone marker may be preceded by the sequence "↑σ" (as in ↑*ke*↓*nya*), by the sequence "↓..." (as in ↓*maha*↑*wu*), by both (as in ↓*ni*↑*ki*↓*li*), or by neither (as in ↑*pɛlɛ* or ↓*bɛlɛ*). The second condition insures that two successive tone markers must have different values.

Observe now that the absence of the HHL and HLH tone contours in Mende is included in the lexical structure conditions above, because a word with a HHL tone contour would have the representation

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*It was brought to my attention after the completion of this chapter that the facts which this lexical structure condition accounts for have been challenged by Dwyer (1977), who provides the following examples of the HLH and HHL lexical tone patterns in Mende:

```
yambuwu 'tree', lansana (proper name), hokpo 'navel', kɔnyɔ 'friend',
 H  L H          H  L H                 H  HL          H HL
ijipi 'Egypt', simenti 'cement', pɛtiku 'spectacles'.  These new facts
H H L          H H L             H H L
```

show that the lexical structure condition of (8.2-5.a) does not hold and that Mende is not a pitch accent language, as is claimed here. This part of the analysis must therefore serve only as an example of how lexical gaps of this sort could, in principle, be accounted for within a dynamic-tone theory. Dwyer also calls attention to the existence of a few lexical items which make use of a downstepped high tone. I see no serious problem in incorporating these items into the analysis of Mende which I propose below, all of which is still valid, I believe, except for the lexical structure conditions of (8.2-5).

Leben (1977), in reply to Dwyer, has abandoned his claim that the HLH and HHL tone melodies do not occur as lexical tone patterns in Mende, and has made some changes in his analysis in keeping with recent developments in the autosegmental theory of tone.

$[\uparrow C_0VC_0V\downarrow C_0V]$ or $[\uparrow C_0VC_0V\downarrow]$, and a word with the tone contour HLH would have the representation $[\uparrow C_0V\downarrow C_0V\uparrow C_0V]$ or $[\uparrow C_0V\downarrow C_0V\uparrow]$, but none of these representations is provided for in (8.2-5.a) This method of excluding the non-occurring tone contours makes predictions about what tone melodies one may expect to find co-existing in the same language. For example, the following are some of the predictions which the theory makes about a pitch-accent language with the same conventions for the realization of tone markers as Mende, and which is like Mende in that its basic tone marker is the last tone marker of the word:

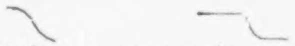
(8.2-6) a. The language may have either LHL (=↓σ↑σ↓ ...) or HHL (=↑σσ↓...) as a tone melody, but it cannot have both, because the lexical structure condition which allows the one simultaneously excludes the other. There is a similar conflict between HLH and LLH.

b. It will be difficult for the language to have the lexical tone melody LHL (=↓σ↑σ↓...) without also having HL, or to have HLH (=↑σ↓σ↑...) without also having LH, because the lexical structure condition which allows the first simultaneously allows the second.

In this way the dynamic-tone theory provides a partial explanation for the occurrence of certain lexical tone melodies in Mende, and the non-occurrence of others.[21]

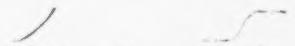
In addition to providing a partial explanation for the gaps in the lexical tone contours of Mende, the dynamic-tone analysis permits a very simple account of the changes from lexical tone which are found in certain contexts. For example, Leben points out that a rising or falling glide at the end of a word is lost before a toneless preposition[22] such as *ma* 'on' or *hu* 'in', so that we find

(8.2-7) a.



↑mbu↓ + ma → ↑mbu↓ma 'on an owl'

b.

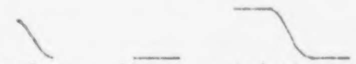


↓mba↑ + hu → ↓mba↑hu 'in rice'

This tone "change" can be accounted for in the dynamic-tone analysis if we assume that monosyllabic prepositions like *ma* and *hu* are separated from their objects by only a single word boundary,[23] and that the convention that a word-final tone marker is pronounced as a gliding tone on the preceding syllable holds only for tone markers at the ends of phonological words, that is, for tone markers which are followed by a double word-boundary, *##*.

A second tone change, the simplification of a rising glide before high and of a falling glide before low, requires the addition of a rule. The relevant data is given below (once again taken from Leben (1973)):

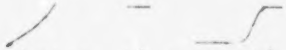
(8.2-8) a.



↑mbu↓ + ↓ŋgaa → ↑mbu↓ŋgaa

'owl' pluralizer 'owls'

b.



↓mba↑ + ↑i → ↓mba↑i

'rice' pluralizer 'the rice'

The loss of one of the ↓'s of (a) and of one of the ↑'s of (b) may be accounted for by means of a rule of the form

(8.2-9) Like Tone Marker Deletion

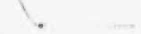
$$\ldots\begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix}\ldots\begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix}\ldots$$

s.d. 1 2 3

s.c. $3 > \emptyset$ Condition: 2 contains no [+tone].

The rule above deletes the ↓ of *↓ŋgaa* and the ↑ of *↑i* in the examples of (8.2-8). I assume, again, that there is only a single word boundary between the head noun and the non-lexical item which follows it, so that the tone marker at the end of the word is realized as a sharp change in pitch at the syllable boundary. Rule (8.2-9) also accounts for the loss of the ↓ of *↓ŋgaa* in contexts like

(8.2-10)



↑ke↓nya ŋgaa 'uncles' (from *↑ke↓nya* + *↓ŋgaa*)

Finally, rule (8.2-9) plays a role in accounting for the tone contours of compounds. The second element of most compounds in Mende has a HL contour when the first element of the compound has the tone melody H, LH, or LLH, as in

(8.2-11) a.

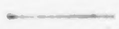
↑kɔ-ha↓ni 'war-thing' (*↑kɔ* 'war')

b.

↓mba↑ ha↓ni 'rice thing' (*↓mba↑* 'rice')

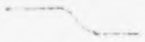
In contrast, when the first element of a compound has the tone melody L, HL, or LHL, the second element is low throughout, as in

(8.2-12) a.



↓kpa-hani 'debt-thing' (↓*kpa* 'debt')

b.



↑mbu↓-hani 'owl-thing' (↑*mbu*↓ 'owl')

The facts of (8.2-11) and (8.2-12) are easily accounted for without the addition of a rule if we assume that compounds in Mende are subject to the following lexical structure condition:

(8.2-13) In a compound of the form $[[W_1][W_2]]$,
$W_2 = \sigma{\downarrow}W_3$ and[24] W_3 contains no tone markers.

This lexical structure condition insures that in the lexical representation of a compound, the second element has a ↓ after its first syllable, and no other tone markers. Thus we obtain the following underlying tone representations for the forms above:

(8.2-14) a. For the forms of (8.2-11):

↑kɔ ha↓ni ↓mba↑ ha↓ni

b. For the forms of (8.2-12):

↓kpa ha↓ni ↑mbu↓ ha↓ni

The tone contours of (a) are correct as they stand; in these cases the underlying and surface tone representations are the same. However, the (b) forms are subject to the rule of Like Tone Marker Deletion, which deletes the underlying ↓ of the second element of the compound, creating the correct surface output in each case. This odd tonal alternation in Mende compounds is thus accounted for in the dynamic-tone theory by a very general rule of the grammar.[25]

Finally, it is necessary to account for the behavior of nouns like *nika* 'cow', for which I have assumed the lexical representation ↓*nika*↑. Nouns of this class have low tone throughout, as we would expect when they precede a high-toned element like ↑*i* 'the'. That is,

(8.2-15)

↓nika↑ + ↑i ⇒ ↓nika ↑i 'the cow'

(By Like Tone Marker Deletion)

However, nouns of this class have LH tone at the end of a phrase, or before a low-toned element, as in

(8.2-16) a.

↓nika↑ ⇒ ↓ni↑ka 'cow' (isolation form)

b.
↓nika↑ + ↓ŋgaa ⇒ ↓ni↑ka↓ŋgaa 'cows'

The change in the tone shape of *↓nika↑* in examples like these may be accounted for by means of a rule of ↑-Retraction, stated below:

(8.2-17) σ σ ↑ (↓ ...) ##

s.d. 1 2 3 4 5 6

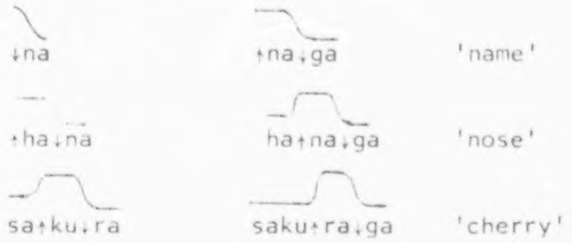
s.c. Transpose 2 and 3.

The first expansion of this rule, with the parenthesized material included, retracts a ↑ before a low-toned element, as in (8.2-16.b), and the second expansion, without the parenthesized material, retracts a ↑ from the end of a phonological word, as in (8.2-16.a).[26]

8.3 The Kagoshima dialect of Japanese. We have now seen examples of pitch-accent systems in which (i) the basic tone marker is a ↓ and its position is unpredictable (Tokyo Japanese), (ii) the basic tone marker is a ↑ and its position is unpredictable (Serbo-Croatian), and (iii) the basic tone marker may be either a ↓ or a ↑ and its position is unpredictable (Mende). There are two other logically possible sorts of tonal systems which fit our definition of a pitch-accent language as one with lexical tone such that there is at most one tone marker per word whose position and/or direction is unpredictable. One possibility which we have not yet considered is that of a language in which the position of the basic tone marker is fixed but its direction may vary; the other is a language in which the lexical tone contours of words are entirely predictable. The Kagoshima dialect of Japanese appears to be a language of the former type. Northern Tepehuan, an American Indian Language, is an example of the latter type.

A list of Kagoshima nouns (taken from Haraguchi (1975)) is given below, togehter with their pitch contours and the tone representations which I am assuming for them:

(8.3-1) a. Words of class I.



↓na	↑na↓ga	'name'
↑ha↓na	ha↑na↓ga	'nose'
sa↑ku↓ra	saku↑ra↓ga	'cherry'

kaga↑ri↓bi	kagari↑bi↓ga	'watch fire'

b. Words of class II.

↑na	na↑ga	'vegetable'
ha↑na	hana↑ga	'flower'
usa↑gi	usagi↑ga	'rabbit'
iroga↑mi	irogami↑ga	'colored paper'

The tone representations above translate into the correct output pitch contours if we assume the following tone-realization conventions for Kagoshima:

(8.3-2) a. A tone marker between two syllables is realized as a change in pitch at the syllable boundary.

b. A ↑ at the beginning of a breath-group is not pronounced, but a ↓ in this position is realized as a fall in pitch during the following syllable.

Assuming, then, that the tone representations in (8.3-1) are correct, it is easy to see that the fundamental difference between words of class I and words of class II in Kagoshima is in the direction of the tone marker which appears before the final syllable of every word. The rest of the tone contour is predictable from the direction of this "basic" tone marker, by the lexical structure condition given below:

(8.3-3) A word in Kagoshima has the tone shape[27]

$$[\ldots(\uparrow\sigma)[+\text{tone}]\sigma]$$
$$\;\;1\;\;\;\;2\;\;\;\;\;\;\;3\;\;\;\;\;\;4$$

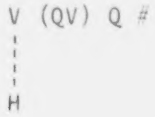
where 1 contains no tone markers, where 2 is present if and only if 3 is a ↓, and where 3 has the same value for all words derived from the same stem.

By the lexical structure condition above, a word such as *sa↑ku↓ra* 'cherry', whose basic tone marker is a ↓, has a ↑ before its penultimate syllable, but a work like *usa↑gi* 'rabbit' has no tone markers except for its basic ↑. In addition, since the word *sa↑ku↓ra* has a ↓ for its basic tone marker, the basic tone marker of *saku↑ra↓ga* ('cherry' + nominative) must also be a ↓.

This analysis of Kagoshima compares favorably, I believe, with Haraguchi's autosegmental analysis, which is outlined below:

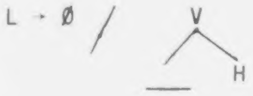
(8.3-4) a. Kagoshima has the basic tone melody LHL.

b. The basic tone melody is associated with the phonological string by means of the tone association rule



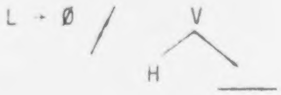
where Q contains no V, and where the material in parentheses is chosen for words of class I, but not for words of class II.

c. There is a tone-simplification rule of the form



which applies to words of both classes.

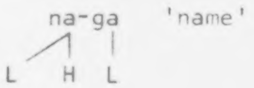
d. There is a tone-simplification rule of the form

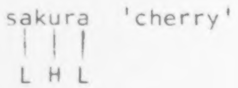


which applies to class II words only.

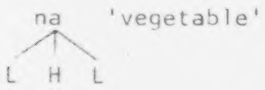
The application of Haraguchi's tone-association rule is illustrated below:

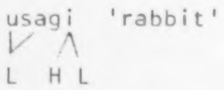
(8.3-5) a. As applied to class I words.


na-ga
'name'
L H L


sakura
'cherry'
L H L

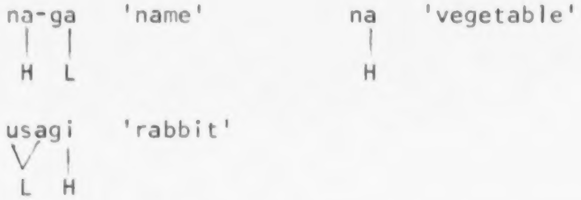
b. As applied to class II words.


na
'vegetable'
L H L


usagi
'rabbit'
L H L

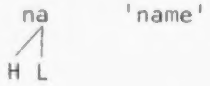
The surface forms are then derived by applying the Tone Simplification Rule (8.3-4.c) to the underlying forms of *na-ga* 'name' and *na* 'vegetable', and the Tone Simplification Rule (8.3-4.d) to the underlying form of *na* 'vegetable' and *usagi* 'rabbit', producing the output forms

(8.3-6)



Haraguchi's analysis is ad hoc, I believe, in that the two properties which it assigns to class II words, namely that they undergo a special form of the tone-association rule, and that they alone are subject to the tone-simplification rule of (8.3-4.d), are not related to one another in any principled way. In addition, the treatment of monosyllabic nouns of class I, such as

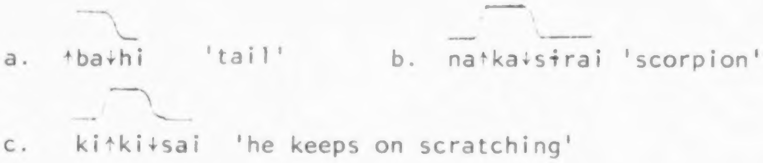
(8.3-7)



is awkward, since monosyllabic words cannot undergo the usual tone-association rule for members of class I (i.e. $\underset{\underset{H}{\vdots}}{V}\ Q\ V\ Q\ \#$, where Q contains no V) but must undergo the class II version (without QV).[28]

8.4 Northern Tepehuan. Northern Tepehuan is a language whose lexical tone contours are entirely predictable, as was observed by Woo (1969). In particular, every word has the tone shape [...↑...↓...], with the ↓ coming after the first syllable if the word has only one or two syllables, and otherwise after the second. Some examples are given below:

(8.4-1)


a. ↑ba↓hi 'tail'
b. na↑ka↓sɨrai 'scorpion'
c. ki↑ki↓sai 'he keeps on scratching'

Observing that in these examples the ↑ of the tone contour comes one syllable before the ↓, we may set up the following approximate lexical structure condition for Northern Tepehuan:

(8.4-2) A word of Northern Tepehuan has the form[29]

[(σ) ↑ σ ↓ (σ...)]
1 2 3 4 5

where 1 is present only if 5 is also present.

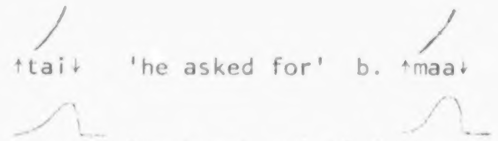
This lexical structure condition expands into the two subconditions

(8.4-3) a. [σ ↑ σ ↓ σ...]
1 2 3 4 5

b. [↑ σ ↓ (σ)]
2 3 4 5

Na↑ka↓sɨrai and *ki↑ki↓sai* are words which follow the first condition, while *↑ba↓hi* follows the second. Notice that this lexical structure condition provides the tone representations shown below for one- and two-syllable words with long first syllables.[30]

(8.4-4)

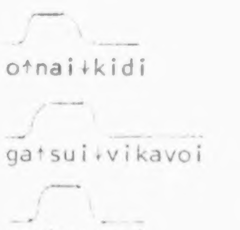


a. ↑tai↓ 'he asked for' b. ↑maa↓ 'he gave'

c. ↑muu↓li 'to break stick' d. ↑koo↓so 'he sleeps'

I will account for the rising tone on the first syllables of these words by assuming that in Northern Tepehuan a ↑ which is the first element of a breath-group is realized as a rising glide when the following syllable is long. Example (8.4-1.a) shows that an initial ↑ is not pronounced (or at least is not strongly pronounced) when the syllable which follows it is short. Examples (8.4-4.a) and (8.4-4.b) show that a tone marker at the end of a breath-group in Northern Tepehuan is not pronounced. Otherwise the tone-realization conventions of Northern Tepehuan are similar to those of Kagoshima Japanese, in that a tone marker between two syllables is realized as a change in pitch at the syllable boundary, whatever the length of the syllables on either side of it:

(8.4-5)



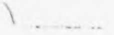
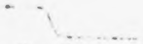
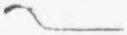
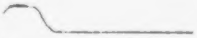
o↑nai↓kidi 'with the salt'

ga↑sui↓vikavoi 'brush'

va↑kua↓nai 'to wash'

There are two exceptions to the generalization that the ↓ of the lexical tone contour comes after the second syllable of a multi-syllable word. Words in which the second syllable begins with a consonant cluster always have their ↓ after the first syllable, as do words in which the second syllable begins with a consonant and is the first syllable of a suffix. For example, we find

(8.4-6) Where the second syllable begins with a consonant cluster.

			
↑a↓st^{y}ani	'throw it out'	↑ši↓špuani	'it explodes'
			
↑ta↓škali	'tortilla'	↑sa↓studuakana	'clever'

(8.4-7) Where the second syllable begins with a consonant and is the first syllable of a suffix.

↑tai↓+kidi	'with the fire'	↑sai↓+t^{y}iki	'he got stuck'

The exceptional cases above may be accounted for by requiring that the syllable which is surrounded by tone markers must begin with a single non-syllabic segment (C), and that if that non-syllabic segment is preceded by a morpheme boundary, it must be a glide. The amended version of the lexical structure condition is given below:

(8.4-8) A word of Northern Tepehuan has the form

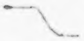
$$\begin{array}{ccccccc} [(\sigma) & (+) & \uparrow & [C_1^1 & \ldots]_\sigma & \downarrow & (\sigma\ldots)] \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 \end{array}$$

where 1 is present only if 7 is also present, and where if 2 is present, 4 is a glide.

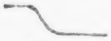
Words like ↑*ta*↓*skali* and ↑*tai*↓*kidi*, being unable to meet the structural description of the first expansion of this lexical structure condition (with 1 present), undergo the second expansion instead.

The last group of words to be considered are words in which the second syllable consists of a syllabic vowel only. Some examples of words of this sort are given below:

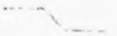
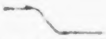
(8.4-9)



a. ↑mo↓o 'head' b. ↑a↓i



c. ↑moo↓dɨ 'his head' d. ↑ai↓yata 'he caught up to him'

e. ↑baa↓gai 'eagle' f. ↑aa↓duni 'relatives'

The forms of (a) and (b) above are perfectly regular, with an initial ↑ and a ↓ after the first syllable, as is usual for bisyllabic forms. However, the multi-syllabic forms of (c)-(f) are irregular, as is to be expected, since the fact that their second syllables do not begin with a consonant prevents them from conforming to the lexical structure condition of (8.4-8) in the regular manner.[31] Words of this sort may be accommodated by eliminating the requirement that terms 4 and 5 of the lexical structure condition must make up a syllable; instead, we should require only that 5 contain no consonants. The final version of the lexical structure condition for Northern Tepehuan is given below:

(8.4-10) A word of Northern Tepehuan has the form

$${}_{\text{STEM}}[\underset{1}{(\sigma)}\ \underset{2}{(+)}\ \underset{3}{\uparrow}\ \underset{4}{C_1^1}\ \underset{5}{\ldots}\ \underset{6}{\downarrow}\underset{7}{(\sigma}\underset{8}{\ldots)}]$$

where (i) 1 is present only if 7 is also present
(ii) if 2 is present, 4 is a glide
(iii) 5 contains no consonants
(iv) if 8 contains segments, 7 = [C ...]

the fourth condition above is to allow the bi-syllables *↑mo↓o* 'head' and *↑a↓i* to have their ↓ after the first syllable, while not allowing multi-syllabic words like

(8.4-11) *↑mo↓odi

While the lexical structure condition of (8.4-10) is complex, it is significantly less complex than Woo's level-tone analysis. I repeat Woo's rules below for the reader who wishes to make a rough comparison of the complexity of the two analyses:

(8.4-12) a. $V \rightarrow [+L]$

b. $V \rightarrow [+H] / {}_{\text{STEM}}[\,(C)(V)\left(\begin{bmatrix}V\\ -\text{syl}\end{bmatrix}\right)\left(\begin{bmatrix}V\\ -\text{syl}\end{bmatrix}\right)(\langle + \rangle \langle -\text{cons} \rangle)\underline{\qquad}$

c. $V \rightarrow [+H] / \underline{\qquad}(C)\begin{bmatrix}V\\ +H\\ +\text{syl}\end{bmatrix}\begin{bmatrix}V\\ -\text{syl}\\ \end{bmatrix}\#\#$

d. $V \rightarrow [+L] / \underline{\qquad}\left(\begin{bmatrix}V\\ -\text{syl}\end{bmatrix}\right)\#\#$

e. $V \rightarrow [+H] / \underset{[\alpha\text{syl}]}{\underline{\qquad\quad}}\begin{bmatrix}V\\ +H\\ \alpha\text{syl}\end{bmatrix}$

f. $V \rightarrow [+H] / \begin{bmatrix}V\\ +H\end{bmatrix}\underline{\qquad\quad}\begin{Bmatrix}V\\ C\end{Bmatrix}$[32]

9. CONCLUSION

In summary, I have argued here that the tone contours of pitch-accent languages should be represented in terms of dynamic-tone units rather than level-tone units. In the particular dynamic-tone system which has been proposed here, tone contours are represented by means of the tone markers ↓ (= $\begin{bmatrix}+\text{tone}\\ +\text{fall}\end{bmatrix}$) and ↑ (= $\begin{bmatrix}+\text{tone}\\ -\text{fall}\end{bmatrix}$), which appear in the phonological string at points of pitch change. The distribution of tone markers is restricted by well-formedness conditions which prohibit them from appearing inside tone-bearing units, or in sequence with one another within the same word. A particular tone marker may be realized either as a sharp change in pitch between two tone-bearing units or as a gliding tone on a single tone-bearing unit, depending on its position in the string and on the conventions for the realization of tone markers which hold in that language. This treatment of gliding tones assumes that tone markers in equivalent positions in the same language will be realized in the same way.

One of the fundamental advantages of the dynamic-tone theory which has been proposed here is that it allows us to use the same system of tone representation for all languages, as will be seen more clearly in subsequent chapters. Thus, in this theory, the traditional distinction between pitch-accent languages and tone languages is simply a difference in the predictability of lexical tone contours and not a difference in the manner in which those tone contours are represented. I have defined a pitch-accent language as one with lexical tone in which there is at most one tone marker per word whose position and/or direction is unpredictable. However, the notion "pitch-accent language" does not play any role in the theory itself.

If we define a pitch-accent language as one in which there is at most one tone marker per word whose position and/or direction is unpredictable, then the theory predicts five possible varieties of pitch-accent languages, as follows:

(9-1) a. The basic tone marker is always a ↓, and its position is unpredictable. (Tokyo Japanese)

b. The basic tone marker is always a ↑, and its position is unpredictable. (Serbo-Croatian)

c. The basic tone marker may be either a ↓ or a ↑, and its position is unpredictable. (Mende)

d. The basic tone marker may be either a ↓ or a ↑, but its position is predictable. (Kagoshima Japanese)

e. The lexical tone contour of a word is entirely predictable. (Northern Tepehuan)

We have found examples of each of these five sorts of pitch-accent languages, as indicated in parentheses after each description above.

In addition to the elegance of the overall picture of lexical tone which the dynamic-tone theory gives us, we have also found advantages to this approach within the grammar of each individual language which we have examined. For example, we have found that the dynamic-tone theory is superior to level-tone theories in its ability to account for certain downdrift phenomena in Tokyo Japanese and in its ability to predict the difference between unaccented and final-accented words in this and other dialects of Japanese. In Serbo-Croatian, the dynamic-tone theory allows a particularly elegant representation of the tonal properties of stems, so that the tone contour of a word is predictable in every case from the lexical representation of its stem. For Mende, the theory provides a simple way of stating which tone melodies may occur in the lexical representations of words, and a principled account of the gaps which occur. In addition, the theory allows an elegant account of the tonal properties of Mende compounds. In Kagoshima Japanese, the theory allows us to account for the difference between the two tone classes, Class I and Class II, by means of differences in their lexical tone contours alone, and in Northern Tepehuan it allows a somewhat simpler statement of the lexical structure conditions which determine the tone contours of words than appears to be possible in a level-tone theory.

In the chapter which follows, I will show that the dynamic-tone theory also offers advantages for the analysis of tone languages, whose lexical tone contours are less predictable than those of the languages which we have considered in this chapter.

FOOTNOTES

[1] This is only a rough statement of the facts. We will be increasing the accuracy of the description as we go along.

[2] McCawley leaves the domain of this rule unspecified. It should be noted that there are some other kinds of phrases, in particular compounds and noun-particle combinations where the particle is one of the set *gu'rai* 'as much as', *rasi'i* 'like', *dake'* 'only', in which the accent of the FIRST element of the phrase is the one which is eliminated. Thus we find, for example

(i) ?i/noti gu\rai 'as much as a life'
(*?i'noti + gu'rai*)

[3] This statement is not quite true. We will see below that the rule should in fact apply to nouns like *?i↓noti*, inserting a ↑ BEFORE the first syllable of the word rather than after it, giving this word the tone representation *↑?i↓noti* when it appears initially in a phrase. The rule applies in the same way to words like *kooban* 'police box', which have long first syllables. A more accurate statement of the rule is given below:

(ii) $\emptyset \rightarrow \uparrow / \ \$([C_0V]_\sigma) \ \_\_\__\sigma$

[4] But see the footnote at the end of the Introduction.

[5] Alternatively, the well-formedness conditions of (3-1) might be viewed as output conditions; in this version of the theory, strings like those of (3-2) would be allowed to exist as underlying forms, but would have to be eliminated before reaching the surface level. However, this version of the theory would allow questionable derivations like the following hypothetical one:

(iii)

Underlying form A	Underlying form B	
CV↑CV	CVCV	
CV↓↑CV	CV↓CV	Rule (a): Ø ⇒ ↓/#CV___
...	CVCV↓	Rule (b): CV↓CV ⇒ CVCV↓
CV↓CV	...	Rule (c): ↑ ⇒ Ø/↓___

What is questionable about this derivation is that the underlying distinction between A and B is preserved under application of rule (a), so that rule (b) then applies to B but not to A. In the actual cases which I know of, underlying distinctions of this sort are not maintained. I therefore assume that the application of rule (a) obliterates the underlying distinction between A and B, producing the intermediate form *CV+CV* in both instances.

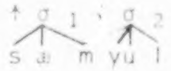
[6] Goldsmith (1976) has proposed the following rule for the lengthening of monosyllabic adjectives like *fine* in (3-3.b):

(iv) The Monosyllabic Lengthening Rule

$$V \rightarrow \text{lengthened} \;/\; \#\#C_0 \underline{\quad} C_0\#\#$$

[7] G. N. Clements has pointed out to me that the [m] of example (3-6) is probably ambisyllabic (cf. Kahn (1977)), raising a question about the position of the ↓ which I have postulated between the two syllables [sæm] and [yul]. Whatever the facts of this particular case, the existence of ambisyllabic segments undoubtedly poses a problem for the theory, one which might be resolved by establishing a syllabic level in the phonological representation, and placing the tone markers on that level rather than in the same string with the phonological segments. In this version of the theory, [sæmyul] in (3-6) could be represented as follows:

(v)



[8] I use the word "convention" here to mean a principle which gives a phonetic interpretation to the formal representation. Conventions for the realization of tone markers are partly universal and partly language-specific, as we will see below.

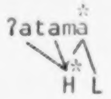
[9] I use the word "phrase" here and immediately below interchangeably with "breath group", though later I will distinguish between them. The question

(vi) Would you like a red one, or a green one?

would ordinarily be pronounced as two phrases, but it makes up a single breath group.

[10] Goldsmith (1976) proposes a different tone-association process for accentual languages. In particular, Goldsmith proposes that in accentual languages, both the words and the tone melodies have "starred" segments, and the tone-association rule says simply "Associate the starred element of the tone melody

with the starred element of the phonological string." For example, in Goldsmith's version, the tone melody of Tokyo Japanese would be $\overset{*}{H}L$, with the "H" being the starred element. This melody would then map onto a starred word like *ʔatam$\overset{*}{a}$* 'head' in just the same way as in Haraguchi's theory, as shown below:

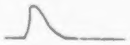


While Goldsmith's tone-mapping rule has the advantage of being a universal rule for all accentual languages, there is a serious problem with it in that, as Haraguchi has pointed out, it does not provide any way of mapping the tone melody onto unaccented words like *miyako* 'city'. It would not do, for example, to simply assign a star to the final syllable of an unaccented word, for then there would be no way to account for the distinction between these two classes of words in the speech of speakers who end *ʔatam$\overset{*}{a}$* with a falling glide, but who end *miyako* with a level high tone.

There are also differences in Haraguchi's and Goldsmith's statements of the tone-association rules for non-accentual languages, but these differences are without theoretical consequence, as far as I can see.

[11] Actually, the rule must be rather more complicated than this, for, according to Haraguchi, ALL speakers of Tokyo Japanese retain the falling glide at the end of a final-accented word in contexts like

(viii)



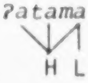
hana saku 'Flowers bloom.'
(repeated from (v) above)

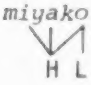
Thus, for speakers who use the tone simplification rule of (6-13), that rule must be prevented from applying to final-accented nouns in contexts of this sort. Haraguchi gives the following statement of the tone simplification rule for speakers of this type

$$\text{(ix)}\quad L \rightarrow \emptyset \;/\; [V, \langle -* \rangle_a] \langle \#\#C_0VX \rangle_b \#\#$$

where b ⊃ a.

Rule (ix) simplifies the contour at the end of *ʔatam$\overset{*}{a}$* only at the end of a breath-group, while applying to unaccented nouns like *miyako* in all contexts. These difficulties in accounting for the





differences between final-accented nouns and unaccented nouns are a serious weakness in the autosegmental treatment of Japanese tone. The distinction is far more easily accounted for in a dynamic-tone theory, where the fact that unaccented nouns like *miʃyako* never have a falling glide on the final syllable is entirely expected, since nouns of this type never have final ↓'s at any stage of the derivation. The falling glide at the end of words like *ʔa↑tama↓* is accounted for by means of a realization convention that a word-final tone marker is to be realized as a gliding tone on the syllable which precedes it. Speakers who do not pronounce this falling glide at the end of a breath group presumably have a rule of the form

$$\text{(x)}\quad \downarrow \rightarrow \emptyset \ / \ \underset{[-\text{long}]}{\sigma}\ \underline{\quad}\ \$\$$$

where the symbol "$$" marks the end of a breath group.

[12] Actually, this statement is true only for Haraguchi's version of the theory. (See footnote (10) above.)

[13] G. N. Clements has pointed out to me that solution (a) is not empirically equivalent to the others, since it alone predicts that a following particle will drop to low tone.

[14] But see example (viii) in footnote (11) for facts which require a complication of this rule.

[15] The facts presented here are taken from Goodluck (1977).

[16] Alternatively, words like *↑vo↓du* 'water' (acc. sg.) could be assumed to be toneless in lexical representation, with their surface tone contours assigned by rules of the form

$$\text{(xi)}\quad \emptyset \rightarrow \uparrow \ / \ \underline{\quad}\ Q\ \#\qquad \text{, where Q contains no } \uparrow.$$

$$\text{(xii)}\quad \emptyset \rightarrow \downarrow \ / \ \uparrow \sigma\ \underline{\quad\quad}$$

I have assumed, wherever possible, that tone contours are assigned in the lexicon by means of lexical structure conditions, rather than at the surface by means of phonological rules. However, the argument does not at any point depend on this assumption.

[17] The autosegmental analysis outlined above is, essentially, the one proposed by Goodluck (1977).

[18] Leben lists a monosyllabic word, $\underset{\text{LHL}}{\textit{mba}}$, with the tone melody LHL, that is, with a rising-falling contour on a single syllable. Given that the tone-bearing unit in Mende is the syllable, and that phrase-initial tone markers are not pronounced, the dynamic-

tone theory does not allow the representation of such a tone contour. Leben himself, in a footnote, questions the accuracy of this representation, noting that Innes (1969) records it with a long vowel and that Dwyer (personal communication) has observed that it may have been derived from a disyllable. I will assume that it is still a disyllable, and that its tone representation is *↓mba↑a↓*. In addition I am assuming, as does Leben, that words like $\underset{\text{LH L}}{\textit{gɔta}}$ 'gutter', $\underset{\text{LH L}}{\textit{gɔtɔ}}$ 'rope', $\underset{\text{LH L}}{\textit{tolo}}$ 'kola nut', $\underset{\text{LH L}}{\textit{tika}}$ 'coal', $\underset{\text{LH L}}{\textit{mana}}$ 'banana' and $\underset{\text{LH H}}{\textit{bɛsi}}$ 'pig', are actually trisyllabic, with what is written as a single vowel with a rising contour on it being in fact a sequence of two syllabic vowels.

[19] Leben assumes the tone representation $\underset{\text{L H}}{\textit{nika}}$ rather than $\underset{\text{L LH}}{\textit{nika}}$ for words of this class. I am changing his analysis at this point for reasons which will be given below.

[20] This solution was suggested to me by G. N. Clements (personal communication), along with an alternative -- that Mende has a constraint against tone melodies containing more than one H.

[21] Notice that the analysis which has been given here could not simply be translated into level-tone terms. In particular, it would not be possible to predict the level-tone contour of a Mende word from the nature and position of its last tone specification because, for example, both $\underset{\text{H L}}{\textit{kenya}}$ and $\underset{\text{L HL}}{\textit{nyaha}}$ have a low tone associated with the last syllable of the word as their final tone specification, but the two words differ as to whether the preceding high tone segment is associated with that same syllable or with the syllable before it.

[22] Toneless prepositions are, of course, exceptions to the lexical structure condition of (8.2-5.a).

[23] I am assuming word-boundary conventions of the sort first proposed by Chomsky and Halle (1968) and developed further by Selkirk (1972) whereby words are, in general, separated from one another by double word boundaries (##), but there is only a single word-boundary between a short "grammatical" word such as a preposition or an article and an adjacent word which is a sister to it. I will discuss the word-boundary conventions in greater detail in Chapter VIII.

[24] Nothing depends on the assumption I make here that the underlying tone representations of Mende compounds are adjusted in the lexicon rather than by surface-level rules.

[25] Leben's analysis of the same facts is outlined below for the reader who wishes to compare the two analyses:

(xiii) Compound Formation

The lexical tones of the second element of a compound are replaced by the tone melody L.

(xiv) Tone Copying

Copy the last tone of the preceding element onto a toneless preposition or onto the second element of a compound.

(xv) Tone Spreading

$H \rightarrow L \,/\, L \underline{\quad} H$

(xvi) Tone Simplification

$\widehat{HL}\ L \rightarrow HL$

The application of these rules is illustrated in the sample derivations below:

(xvii)

mbu ma HL	mba hu LH	Underlying Representation
mbu ma HL L	mba hu LH H	Tone Copying
---	mba hu LL H	Tone Spreading
mbu ma H L	---	Tone Simplification

(xviii)

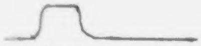
kɔ-hani H ?	kpa-hani L ?	Underlying Representation
kɔ-hani H L L	kpa-hani L L L	Compound Formation
kɔ-hani H HL L	kpa-hani L LL L	Tone Copying
kɔ-hani H H L	---	Tone Simplification

[26] Leben gives nouns like *nika* the lexical representation $\underset{\text{L H}}{\textit{nika}}$ and uses the rule of Tone Spreading (above) to account for their low tone before a high-toned element like *i*. The disadvantage of Leben's analysis is that he must then mark nouns like $\underset{\text{L H}}{\textit{navo}}$, which keep their lexical LH-contour in all contexts, as exceptions to the rule of Tone Spreading, which is otherwise a very general phonological process.

[27] I am assuming here that a particle like *ga* may be adjoined to a noun in its lexical entry. If this assumption should prove to be untenable, then it would be necessary to assign the tone contours of Kagoshima words at the surface rather than in the lexicon. The lexical structure condition of (8.3-3) is easily translatable into phonological rules.

[28] An additional inadequacy in Haraguchi's analysis is that it does not provide for the "accent-reduction" process, which, I assume, applies in the same way in Kagoshima as in other dialects of Japanese. In other words, I assume that the sentence "It is a cherry" (*saku↓ra* 'cherry' + *de↓su* 'it is') is pronounced

(xix)



sa↑ku↓ra desu

in Kagoshima, just as in other dialects of Japanese. It will be difficult to account for facts like these within the autosegmental theory without analyzing Kagoshima as an accentual language.

[29] Woo points out that prefixes do not "count" in establishing the tone contour; in other words, the beginning of the STEM is counted as the beginning of the word with respect to this lexical structure condition.

[30] There are apparently no one-syllable words with short vowels.

[31] See Woo for evidence that the second vowel in words of this type is syllabic, as opposed to the second vowel in words like *↑maa↓* 'he gave' (8.4-4.b), which is non-syllabic.

[32] Woo's rules are, of course, expressed in a segmental theory of tone rather than an autosegmental theory; however, I see no reason to think that her rules could be simplified by translating them into autosegmental terms.

CHAPTER II

ON THE ANALYSIS OF TONE LANGUAGES

1. Introduction

In the preceding chapter, I argued that the tone contours of pitch-accent languages should be represented by means of dynamic tones, with significance attached to points of pitch change rather than to pitch level. In this chapter I will argue for the same mode of tone representation for tone languages -- that is, for languages which allow more than one unpredictable tone marker in the lexical representation of a word.

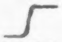
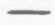
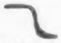
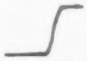
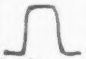
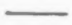
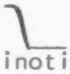
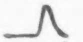
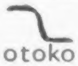
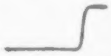
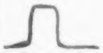
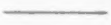
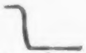
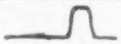
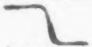
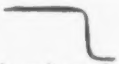
It is important to keep in mind that although we have been able to define the notions "pitch-accent language" and "tone language" within the dynamic-tone theory, the theory itself makes no distinction between the two, for there is no difference in the representation of lexical tone in the two sorts of languages, only in its predictability. Furthermore, there is no reason to expect that languages will divide sharply into two classes with respect to the predictability of their lexical tone contours. Rather, we expect to find a continuum, with some tone languages having lexical tone contours nearly predictable enough to qualify them as pitch-accent systems. I will begin my discussion of tone languages with one of these borderline cases -- Osaka Japanese.

From there I will proceed to two languages which are more clearly of the tone-language class, Kikuyu and Igbo. In these languages I will examine, particularly, the use of a "downstep" as a marker of syntactic structure, arguing that the downstep itself and its effect on the surrounding tone contour can be represented more naturally in a dynamic-tone theory than in a level-tone theory.

Finally, I will consider two Chinese languages -- Mandarin and Chaochow -- in which tone has been argued to be segmental, and in which, according to McCawley (1970a), tone rules are of the same assimilatory and dissimilatory character as the rules which affect purely segmental features. I will begin by showing that the dynamic-tone theory allows a more satisfactory treatment than appears to be possible in a level-tone theory of the special tonal properties of low-toned and unstressed syllables in Mandarin. I will then consider the alternation between the "isolation" and "combination" tone contours of syllables in Chaochow, showing that independently-motivated dynamic representations of the two forms of each tone can be related to one another by means of a simple and natural rule.

2. Osaka Japanese

Osaka Japanese has the lexical tone contours illustrated below (data from Haraguchi (1975)):

(2-1)	LH	LHL	H	HL
Two-mora nouns	 sora 'sky'	 ame 'rain'	 take 'bamboo'	 yama 'mountain
Three-mora nouns	 suzume 'sparrow'	 kabuto 'helmet'	 sakura 'cherry tree'	 inoti 'life'
		 matti 'match'		 otoko 'man'
Four-mora nouns	 tukemono 'pictures'	 bitamin 'vitamin'	 niwatori 'children'	 uguisu 'nightin-gale'
		 nokogiri 'sow'		 bentoo 'lunch'
				 kaminari 'thunder'

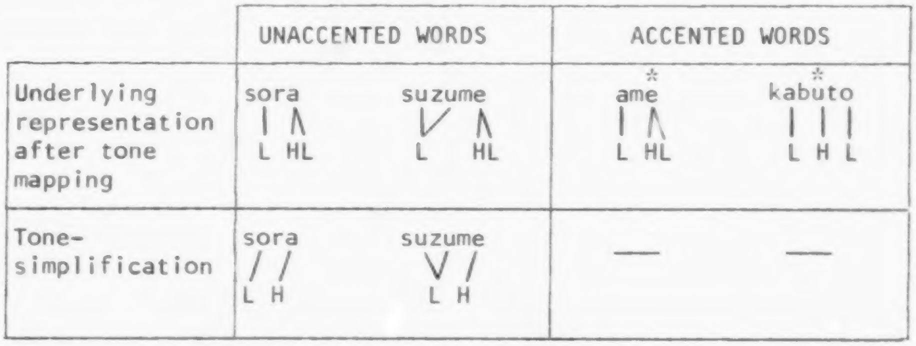
There are no one-mora nouns in Osaka, since nouns like e∫e 'picture', $\overline{ee}$ 'handle', and $\overline{na}\backslash\underline{a}$ 'name', which have one mora in combination with a particle, are lengthened to two moras in their isolation forms.

Haraguchi accounts for the lexical tone contours above by dividing the words of Osaka Japanese into the two tone-melody classes LHL and HL, with the tone melodies mapped on by means of the tone-association rule

(2-2) $\#\#\ Q\ \underset{\underset{H}{\vdots}}{V}$ (where Q contains no $\overset{*}{V}$)

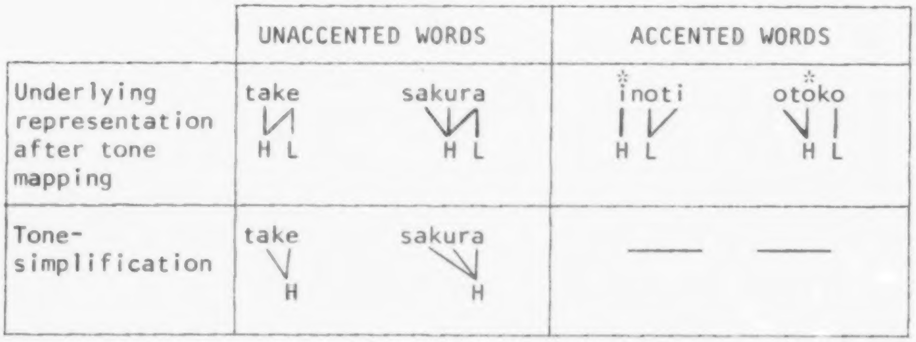
The LH and H contours are the result of mapping the LHL and HL tone melodies, respectively, onto unaccented words. Some sample derivations are given below:

(2-3) a. LHL Tone Melody



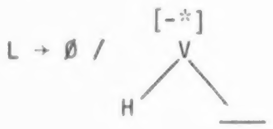
	UNACCENTED WORDS		ACCENTED WORDS	
Underlying representation after tone mapping	sora L HL	suzume L HL	am$\overset{*}{\text{e}}$ L HL	kab$\overset{*}{\text{u}}$to L H L
Tone-simplification	sora L H	suzume L H	—	—

b. HL Tone Melody



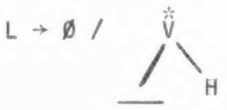
	UNACCENTED WORDS		ACCENTED WORDS	
Underlying representation after tone mapping	take H L	sakura H L	$\overset{*}{\text{i}}$noti H L	ot$\overset{*}{\text{o}}$ko H L
Tone-simplification	take H	sakura H	—	—

The tone-simplification rule which applies in the derivations above is stated

(2-4) 

$$L \rightarrow \emptyset \ / \ \overset{[-*]}{V} \text{ with } H \text{ (left) and } \_\_ \text{ (right)}$$

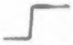
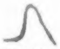
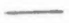
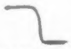
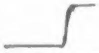
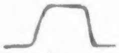
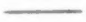
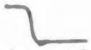
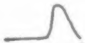
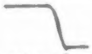
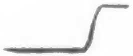
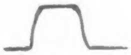
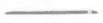
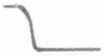
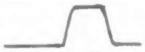
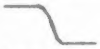
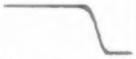
This rule simplifies the falling glide at the end of an unaccented word like *suzu/me* or $\overline{sakura}$, but not at the end of an accented word like *a∫m*$\overset{*}{e}$. In addition, there is a second tone-simplification rule,

(2-5) 

$$L \rightarrow \emptyset \ / \ \overset{*}{V} \text{ with } \_\_ \text{ (left) and } H \text{ (right)}$$

which accounts for the fact that there is never a rising glide on the first syllable of a word.

Now consider a dynamic-tone analysis of Osaka lexical tone. First, let us assume that in Osaka, as in Mende, every word begins with a tone marker which indicates whether it begins on a high or low tone level. Given this assumption, we obtain the tone contours shown below for the words of (2-1):

(2-6)	[↓...↑μ]	[↓...↑μ↓...]	[↑...]	[↑...↓...]
Two-mora nouns	 ↓so↑ra 'sky'	 ↓a↑me 'rain'	 ↑take 'bamboo'	 ↑ya↓ma 'mountain'
Three-mora nouns	 ↓suzu↑me 'sparrow'	 ↓ka↑bu↓to 'helmet'	 ↑sakura 'cherry 'tree'	 ↑i↓noti 'life'
		 ↓mat↑ti↓ 'match'		 ↑oto↓ko 'man'
Four-mora nouns	 tukemo↑no 'pictures'	 bi↑ta↓min 'vitamin'	 ↑niwatori 'children'	 ↑u↓guisu 'nightingale'
		 noko↑gi↓ri 'sow'		 ↑ben↓too 'lunch'
				 ↑kamina↓ri 'thunder'

The examples of (2-6) conform to the lexical structure condition shown below:

(2-7) A noun has the tone representation[1]

a. [↑ ... (↓ μ ...)]

1 2 3 4 5, where 2 and 5 contain no tone markers.

or

(2-7) b. [↓ ... ↑ .. (↓ ...)]

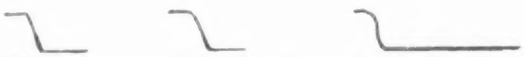
1 2 3 4 5 6, where 2 and 6 contain no tone markers.

Words in the third and fourth columns of the chart follow condition (a), while those in the first and second columns follow condition (b). Notice that Osaka Japanese is not a pitch-accent language by our definition, because there are words like *↑oto↓ko* 'man' whose tone contours are not predictable from the location and direction of one tone marker alone. Thus, knowing that this word begins with a ↑, we cannot tell whether or not it will also contain a ↓, or where that ↓ will appear. Similarly, knowing that it has a ↓ after its second mora, we are unable to predict whether or not there will be a ↑ after its first mora. For this reason, Osaka Japanese must be classified as a tone language, but just barely so, since there are never more than two unpredictable tone markers in the representation of a word.

The autosegmental and dynamic-tone analyses of Osaka lexical tone which are outlined above are, for the most part, intertranslatable, for words which conform to condition (a) of (2-7) are members of Haraguchi's HL class, while those which conform to condition (b) are members of his LHL class. Differences between the two analyses arise at two points: First, the dynamic-tone analysis does not require tone-simplification rules like those of (2-4) and (2-5). Instead, the difference in tone contour between what Haraguchi calls the "accented" and the "unaccented" members of each tone class arises from the fact that there is a part of the lexical tone contour which need not be chosen; the "unaccented" words are those which do not choose the optional part of the tone contour.[2]

The second difference between the two analyses is in their treatment of the "accent-reduction" process, whereby a particle with the tone contour of *gurai* 'only' loses its pitch drop when it follows a noun whose last pitch change is also a ↓. An example is given below:

(2-8)



↑i↓noti + gu↓rai => i↓noti gurai

'life' 'only' 'only a life'

In a dynamic-tone analysis, this "accent-reduction" process is most easily accounted for by means of a rule of Like-Tone-

Marker Deletion, to be stated as follows:

(2-9) Like-Tone-Marker Deletion

$$\begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} \quad \ldots \quad \begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} \quad \ldots \quad \$$$

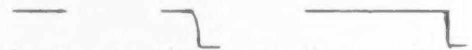
s.d. 1 2 3 4 5

s.c. 3 > Ø

Condition: 2 contains no tone markers.

This rule deletes all but the first of a sequence of ↓'s or ↑'s within a phrase. In particular, if we assume that particles like *gu↓rai* lack initial tone markers, then rule (2-9) accounts for the deletion of the lexical ↓ of *gu↓rai* in (2-8). The rule of Like-Tone-Marker Deletion is needed independently to account for the loss of the initial tone marker of the second word in phrases like the following:

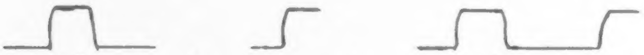
(2-10) a.



↑kono + ↑ho↓n ⇒ ↑kono ho↓n

'this' 'book' 'this book'

b.

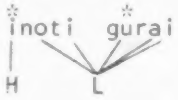


mat↑ti↓- ga + ↓a↑ru ⇒ mat↑ti↓ga a↑ru

'matches' nom. 'exist' 'there are matches'

In using a rule to delete the pitch drop of *gu\rai* in the phrase *i\noti gurai* 'only a life' the dynamic-tone analysis proposed here departs from Haraguchi's autosegmental analysis, in which the loss of this "accent" is accounted for by the tone-assignment rule, which associates the high tone of the tone melody with the first starred vowel of a phonological word, ignoring any subsequent starred vowels within its domain. Thus the application of the tone-assignment rule to the phrase $\overset{*}{i}$*noti g*$\overset{*}{u}$*rai* results in the tone-assignment shown below:

(2-11)



Unfortunately, while Haraguchi's tone-assignment rule works well for phrases of this sort, it does not work for verb forms like the conditional, representative, and tentative, which are doubly accented, as shown below (data from Haraguchi (1975)):

(2-12)

Participial	{Representative Conditional}	Tentative
yoo-te	yokatta{ri ra}	yokaroo
takoo-te	takakatta{ri ra}	takakakaroo
?akoo-te	?akakatta{ri ra}	?akakakaroo

The doubly-accented verb forms in the second and third columns above cannot be handled by Haraguchi's tone-assignment rule unless we assume that there is a double word-boundary between the stem of the verb and the suffix, for if the representative, conditional, and tentative forms are unit phonological words, then the tone-association process should apply to them in just the same way as to the phrase of (2-11), mapping on only a single HL tone melody, and associating the H of that melody with the first starred vowel of the word.

These verb forms do not present any problem for the dynamic-tone analysis, for in this analysis the tone contour of the whole verb can be obtained by simply adding together the individual morpheme-representations which are listed below:

(2-13)

STEMS	SUFFIXES	
↑yo↓	-kat	-o
↓ta↑ka↓	-↑ta↓ra	-te
↓?a↑ka↓	-↑ta↓ri	-↑ro↓o

In other words, in the dynamic-tone analysis which I am proposing here, the fact that *gu↓rai* loses its pitch drop after an accented head, while *↑ta↓ra*, *↑ta↓ri*, and *↑ro↓o* do not, can be attributed to a difference in the lexical tone representations of these items--specifically, to the fact that suffixes may have initial tone markers, while particles like *gu↓rai* do not. That the difference in the tonal behavior of these items can be accounted for by differences in their lexical representation is an advantage of the dynamic-tone theory, because the assumption that there is a strong word boundary in the middle of certain verb forms -- an assumption which is apparently necessary in an autosegmental analysis -- is neither well-motivated not particularly plausible. (See the discussion of the boundary-insertion conventions in Chapter VIII.)

In addition to the rule of Like-Tone-Marker Deletion, there is one other rule of Osaka which affects the lexical tone contours of words in certain contexts. This rule affects words like *so/ra* 'sky', *suzu/me* 'sparrow', and *ka/ta* 'shoulder', which have the lexical tone shape [↓...↑μ]. The effect of the rule is to create variations in the surface position of the ↑, as described below:

(2-14) a. In the isolation pronunciation of the word, the pitch rise comes before the final mora, as in

so↑ra   suzu↑me   ka↑ta

b. When the word combines with a toneless case particle like *ga* (nom.) or *o* (object), the pitch rise comes between the stem and the particle, as in

sora/ga   suzume/ga   kata/ga

c. When the word itself, or a word-particle combination of the type illustrated in (b), comes before a word which begins with a ↑ (i.e., a word which begins on a high tone level), the pitch rise is postponed until the end of the word, as in the examples below:

i. a/ru + to\ki ⇒ aru /to\ki

'certain' 'time' 'once'

ii. ha/si + ku\re ⇒ hasi /ku\re

'chopsticks''pass' 'pass me the chopsticks'

iii. usagi/o + kau ⇒ usagi-o /kau

'rabbit'+obj.'keep' 'keep a rabbit'

iv. yomikake/no + ho\n ⇒ yomikake-no /ho\n

'unfinished' 'book' 'a book not yet read through'

These variations in the position of the pitch rise in words with the lexical tone shape [↓...↑μ] are easily accounted for in a dynamic-tone framework, in the following way: Selkirk (1974) has argued that in a certain elevated style of French, there is only a single word boundary between a "specifier" element and the noun it modifies, or between a noun, verb, or adjective, and its complement; in other words, a sequence of lexical words in these contexts make up a single phonological word. (Again, see the discussion of boundary-insertion in Chapter VIII.) If we assume the same word-boundary convention for Osaka Japanese, then the examples of (2-14a) are all single phonological words, and the variations in the position of the pitch rise may be accounted for by means of the following rule, which moves a pitch rise rightward within a phonological word which contains more than one lexical word:

(2-15) ↑-Shift

... ↑Q # ...

s.d. 1 2 3 4 5 6 7

s.c. Move 3 to the right of 4.

Conditions: (i) Q is the maximal sequence of units which contains no tone marker.

(ii) 2 ≠ Ø

The rule above moves an internal ↑ to a position before the last single word boundary of a domain delineated by double word-boundaries. The application of the rule is illustrated by the following derivations of the phrases *aru/to\ki* 'once' and *usagi/ga* 'rabbit' + nominative marker:

(2-16)

a.	##↓usa↑gi # ga ##	Underlying representation
	Ø→↑	↑-Shift
	↓usagi↑ga	Output
b.	##↓a↑ru #↑to↓ki ##	Underlying representation
	Ø	Like-Tone-Marker Deletion
	Ø → ↑	↑-Shift
	aru ↑to↓ki	Output

Notice that the rule of Like-Tone-Marker Deletion must precede ↑-Shift, or else the structural description of the latter rule will not be met in (2-16 b). The phrase *usagi-o∫kau* 'keep a rabbit' shows that a ↑ may move indefinitely far to the right, as the structural description of the rule indicates. The derivation of this phrase is given below:[3]

(2-17)

##↓usa↑gi # o # ↑kau ##	Underlying form
Ø	Like-Tone-Marker Del.
Ø → ↑	↑-Shift
↓usagi-o ↑kau	Output

In summary, Osaka Japanese provides evidence of the following kinds for the dynamic-tone theory. First, because it is on the borderline between pitch-accent and tone languages, it supports the prediction of the dynamic-tone theory that there should be no sharp division between these two language "classes". Secondly, the fact that "accent-reduction" does not affect verb suffixes like the conditional and tentative suffixes of (2-13) supports a dynamic-tone analysis of this process, in which the "exceptionality" of these suffixes can be established in their lexical representations. Finally, the "tone-spreading" process which applies in phrases like (2-17) above can be stated in a particularly straightforward way within a dynamic-tone theory, as the rightward movement of a tone marker. The ease with which it handles phenomena of this sort is one of the strengths of the dynamic-tone theory, for tone-spreading processes are common among the dialects of Japanese and also among the tone languages of West Africa. (See the discussion of rules of this sort in Chapter IV, sections 3.2 and 3.3, and in Hyman and Shuh (1974)).

3. Igbo[4]

3.1 Lexical tone in Igbo. Looking at tone in terms of pitch levels, one would say that Igbo uses three tones: a high tone, a low tone, and a third tone which is usually called a "downstepped high". The downstepped high tone appears only after a high tone, where it is realized on a level slightly lower than that of the preceding high tone. In relation to the following syllable it behaves like a high tone; that is, a high tone which follows a downstepped high does not go back up, but stays on the same level, and a downstepped high which follows a downstepped high drops down still another level. Thus, the sequence "H 'H H" (where H stands for "high" and 'H for "downstepped high") is realized as

(3.1-1) [- _ _]

and the sequence "H 'H 'H" is realized as

(3.1-2) [¯ - _]

High and low toned syllables appear in lexical representations in any combination. Thus, among nouns, we find the following tone shapes:[5]

(3.1-3)

H	ji 'yam', Chi (person's name)
HH	isi 'head', Ekwe (person's name), eɣ̣u 'goat'
HL	ụlọ 'house', Ogu (person's name), mbe 'tortoise'
LL	ala 'land', Ugho (person's name), ew̃e 'monkey'
LH	ahụ 'body', Adha (person's name), oke 'rat'
HHH	akwụkwọ 'leaf, paper'
HHL	uṽune 'a kind of fruit'
HLH	akabọ 'hedgehog'
HLL	ụbọcị 'day'
LLL	ŋgajị 'spoon'
LLH	aghịgha 'needle'
LHL	ọkụkọ 'hen'
LHH	ŋkuku 'cup'

The downstepped high tone ('H) plays a rather marginal role lexically, but most dialects have a small number of nouns with the tone shape H'H. For example:

(3.1-4)

ego 'money' Igwe : person's name[6]

There are also some three-syllable nouns which make use of the downstepped high tone:

(3.1-5)

HH'H	mkpụrụ 'seed'
H'HH	ŋghadha 'sword'
LH'H	adaka 'chimpanzee'

No word contains two downstepped high tones or a downstepped high tone followed by a low tone.

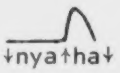
I propose to represent Igbo lexical tone in the following way within the dynamic-tone theory: Let any tone change within a morpheme be represented by a ↑ or ↓, as appropriate, and let any morpheme which ends on a high tone level have a ↓ at the end to signify that fact, while a morpheme which ends on a low tone level will have a final ↑. That gives us the representations shown below for the lexcial tone contours of (3.1-3) (The downstepped high tone will be dealt with in the following section.):

(3.1-6)

H σ↓	HH σσ↓	HHH σσσ↓	LH σ↑σ↓	LHH σ↑σσ↓	HLH σ↓σ↑σ↓	LLH σσ↑σ↓
L σ↑	LL σσ↑	LLL σσσ↑	HL σ↓σ↑	HLL σ↓σσ↑	LHL σ↑σ↓σ↑	HHL σσ↓σ↑

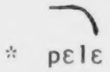
Notice that I have indicated the tone level of a word with respect to adjoining words in the string by means of a tone marker at the end of a word, in contrast to Osaka Japanese and Mende, where this information is represented by a word-initial tone marker. It is possible to define the notions "high tone level" and "low tone level" in all three languages, but the definition is not the same; in Mende and Osaka, a tone-bearing unit has "high" tone just in case the tone marker which most immediately precedes it in the string is a ↑, while in Igbo a tone-bearing unit has high tone just in case the tone marker which most immediately FOLLOWS it is a ↓.[7] The choice is not arbitrary, but is multiply motivated in each language. For example, one piece of evidence for the position of the defining tone marker in Mende is the fact that a tone marker at the end of a word is realized as a gliding tone on the preceding syllable, as in

(3.1-7)



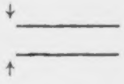
Consequently, the HH word *pɛlɛ* must be represented as ↑*pɛlɛ*, not *pɛlɛ*↓, for the latter representation would be realized, incorrectly, as

(3.1-8)



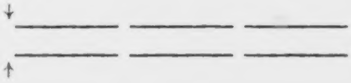
Having determined that the tone level of a Mende word with respect to other words in the string is to be indicated by means of a tone marker at the beginning of the word, we are then committed to a rule of Like-Tone-Marker Deletion for Mende which deletes all but the first of a sequence of like tone markers within the phrase, so that a string of words which are represented individually as

(3.1-9) a.
b.



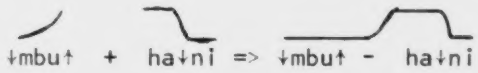
ends up on the surface as

(3.1-10) a.
or b.

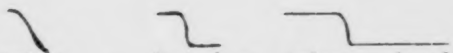


However, the rule of Like-Tone-Marker Deletion in Mende is independently needed to account for a certain tonal alternation which takes place in compounds, producing contrasts like the following:

(3.1-11) a.



(3.1-11) b.

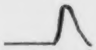


↑mba↓ + ha↓ni ⇒ ↑mba↓ - hani

The fact that the underlying ↓ of *ha↓ni* is present in the surface form in (a), where the preceding tone marker is a ↑, but not in (b), where the preceding tone marker is a ↓, provides independent motivation for the rule of Like-Tone-Marker Deletion and therefore, indirectly, for our decision to indicate the tone level of a Mende word by means of a tone marker at the beginning of the word.

In Osaka, also, the tone level of a word with respect to other words of the string must be indicated by a tone marker at the beginning of the word, for in Osaka, as in Mende, a ↓ at the end of a word is realized as a gliding tone. An example is given below:

(3.1-12)



↓mat↑ti↓ 'matches'

But if the tone marker which indicates word tone level in Osaka comes at the beginning of the word, then the grammar of Osaka must contain a rule of Like-Tone-Marker Deletion exactly like the one which appears in Mende -- that is, a rule which deletes all but the first of a sequence of like tone markers, as in the phrase

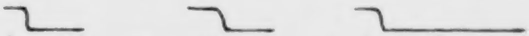
(3.1-13)

↑hon-bako-o + ↑morau ⇒ ↑hon-bako-o morau

'book-shelf + Obj. 'be given' 'I am given a book-shelf'

However, as we saw below, the rule of Like-Tone-Marker Deletion is needed independently in Osaka to account for the loss of the lexical ↓ of a particle like *gu↓rai* when it follows a noun whose last tone marker is also a ↓, as in the example below:

(3.1-14)

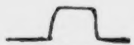


i↓noti + gu↓rai ⇒ i↓noti gurai

(repeated from (2-11))

In addition, the rule of Like-Tone-Marker Deletion plays a role in our account of the rightward shift of a ↑ in phrases like

(3.1-15)



aru↑to↓ki (from *a↑ru* + *↑to↓ki*)

'once' 'certain' 'time'

Thus the position of the tone marker which defines the tone level of a word with respect to adjoining words in the string is multiply motivated in Osaka Japanese, just as it is in Mende.

It should be clear by now that in using a word-FINAL tone marker to indicate the pitch level of a word of Igbo, we commit ourselves to a rule of Like-Tone-Marker Deletion which operates in the opposite direction from the comparable rules of Mende and Osaka. Thus the rule of Like-Tone-Marker Deletion for Igbo must take the form

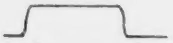
(3.1-16) $\begin{bmatrix} +\text{tone} \\ \langle +\text{fall} \rangle \end{bmatrix} \; \ldots \; \begin{bmatrix} \text{tone} \\ \langle +\text{fall} \rangle \end{bmatrix} \; \ldots \; \$\$^{8}$

s.d 1 2 3 4 5, where 2 contains no tone markers

s.c. 1 > Ø

This rule deletes the first of the underlined ↓'s in the phrase

(3.1-17)



a↑la$\underline{\downarrow}$ + ụ$\underline{\downarrow}$lọ↑ ⇒ a↑la ụ↓lọ↑

'leaving' 'house' 'leaving the house'

In contrast, the ↓ of *a↑la↓* is not deleted when the tone marker which most immediately succeeds it in the string is a ↑ , as in the parallel example

(3.1-18)

a↑la↓ + obodo↑ ⇒ a↑la↓ obodo↑

'village' 'leaving the village'

Both the rule of Like-Tone-Marker Deletion above and our decision to indicate word tone level in Igbo by means of a tone marker at the end of the word will be independently motivated in the analysis which follows below.

Returning to the lexical representations of (3.1-6) above, we see that a tone marker may be found at any syllable boundary within a morpheme, with the following exceptions:

(3.1-19) a. There are no morpheme-initial tone markers.

b. There are no sequences of like tone markers within the same morpheme.

These restrictions on lexical representations in Igbo may be stated formally as follows:

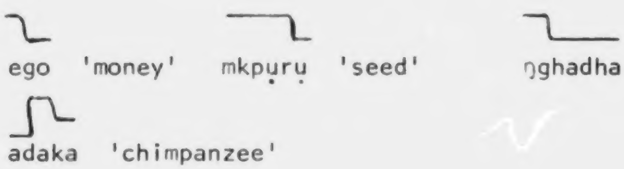
(3.1-20) a. In a morpheme of the form $[[+\text{unit}]_1 \ldots]_2$, 1 is not a tone marker.

b. In a morpheme of the form $[\ldots[+\text{tone}]_1 \ldots_2 [+\text{tone}]_3 \ldots_4]_5$, if 3 contains no tone markers, then $2 \neq 4$.

The rule of Like-Tone-Marker Deletion (3.1-16) and morpheme structure condition (b) above are both too strong as stated, and will have to be weakened somewhat when the analysis is extended to include downstepped high tones.

3.2 The downstepped high tone. We observed above that there are words in Igbo which make use of a "downstepped high" tone. Some examples are

(3.2-1)



ego 'money' mkpụrụ 'seed' ŋghadha 'sword'

adaka 'chimpanzee'

I propose to represent the downstepped high tone in Igbo as a high tone which is preceded by a ↓; that is, I propose to give the lexical representations shown below for the words of (3.2-1):

(3.2-2) e↓go↓ mkpụ↓rụ↓ ŋ↓ghadha↓ a↑da↓ka↓

The morpheme structure condition (3.1-22 b) and the rule of Like-Tone-Marker Deletion (3.1-18) must both be weakened slightly to allow the lexical representations above. In particular, the rule of Like-Tone-Marker Deletion should not delete EVERY ↓ which is followed by another ↓, but only those which come at the end of words. In its revised version, the rule will look like this:

(3.2-3) Like-Tone-Marker Deletion (revised from (3.1-16))

$$\begin{array}{llllll} & \begin{bmatrix}\text{+tone}\\ \text{<+fall>}\end{bmatrix} & \text{<\#\#>} & \ldots & \begin{bmatrix}\text{+tone}\\ \text{<+fall>}\end{bmatrix} & \ldots & \$\$ \\ \text{s.d.} & 1 & 2 & 3 & 4 & 5 & 6, \end{array}$$

where 3 contains no tone markers

s.c. 1 > 0

Stated in this way, the rule will, as desired, delete the ↓ at the end of *a↑la↓* in *a↑la ụ↓lọ↑* 'leaving the house' (3.1-17), but it will not delete the word-internal ↓ of *e↓go↓* 'money'. As before, the rule will delete any ↑ which is immediately succeeded in the string by another ↑.

The morpheme-structure condition (3.1-20 b) must also be revised, to the following:

(3.2-4) In a morpheme of the form $[\underset{1}{\ldots}\underset{2}{[\text{+tone}]}\underset{3}{\ldots}\underset{4}{[\text{+tone}]}\underset{5}{\ldots}]$ where 3 contains no tone markers, 2 ≠ 4, unless 2 = 4 = ↓ and 5 = 0.

Stated in this form, the condition allows a sequence of two ↓'s inside a morpheme just in case the second ↓ is morpheme-final; sequences of ↑'s are not allowed at all. (A similar condition will be needed in a level-tone analysis, to account for the fact that there are never two downstepped high tones in succession and that a downstepped high tone is never followed by a low tone within the same morpheme.[9])

The fact that a drop in pitch from high to downstepped high is only about one third the size of a drop from high to low can be accounted for by means of a rule which reduces the magnitude of a ↓ when the tone marker which most immediately succeeds it in the string is also a ↓. In other words, Igbo has a rule of the form

(3.2-5) ↓-Reduction

↓ ... ↓ ... $$

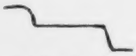
s.d. 1 2 3 4 5, where 2 contains no tone markers.

s.c. Reduce the magnitude of 1 by two thirds.

In reducing the size of a ↓ which is immediately succeeded by another ↓, the rule of ↓-Reduction in effect assigns multiple values for the feature [±fall], which distinguishes tone markers from one another. While this feature has only the two values "+" and "-" on the phonological level, it will eventually be realized in a variety of ways -- in particular, as a large or small fall in pitch, or as a large or small rise in pitch. I anticipate that the numerical value which is ultimately assigned to a particular instance of this feature will in all cases be predictable from its phonological value ("+" or "-") plus the properties of the phonological string in which it appears; in other words, I consider the rule of ↓-Reduction to be a phonetic-detail rule of the sort proposed by Chomsky and Halle (1968) to establish multiple values on the phonetic level for distinctive features which are only binary on the phonological level.

The treatment of the downstepped high tone which is outlined above allows a particularly natural account of a tone "change" which is sometimes found at the end of a phrase in Igbo, namely that a sequence of syllables which would otherwise have the tone contour $H'H(H)_n$ is instead pronounced as $HL(L)_n$. For example, the verb 'don't leave', which ordinarily has the tone contour H'HH, as in

(3.2-6)

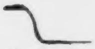


A↓lala↓ + nị↑ ⇒ A↓lala↓nị↑

'don't leave' 'you (pl.)' 'Don't you leave!'

usually has the tone contour HLL when it is phrase-final:

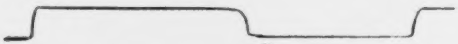
(3.2-7)



A↓lala 'Don't leave!'

Similarly, the noun *ih̃ye↓* 'something', which would ordinarily have the tone contour *i↓h̃ye↓* (H'H) after a conditional verb, is instead given the contour HL in the following sentence, where it is final in its clause:

(3.2-8)



Ka↑m ga rịtụ i↓h̃ye , fụ↑ta↓

'Let me go and eat something and get ready.'

This phenomenon, which I will call phrase-final lowering, can be accounted for in the dynamic-tone framework by means of a rule deleting a ↓ at the end of a phrase, that is, by means of the rule below.

(3.2-9) Phrase-final-↓ Deletion

↓ → ∅ / ____ $

The application of this rule to the underlying forms

(3.2-10) a. A↓lala 'Don't leave!'

and b. Ka↑m ga rịtụ i↓h̃ye↓ 'Let me go eat something.'

produces the representations shown below:

(3.2-11) a. A↓lala↓

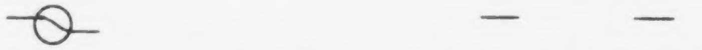
and b. Ka↑m ga rịtụ i↓h̃ye

The underlined ↓'s in these phrases, not being followed by any tone marker at all, are not subject to the rule of ↓-Reduction and so are realized as "big" pitch drops of the sort ordinarily found before low-toned syllables.

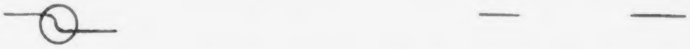
Phrase-final lowering is not obligatory; the underlined ↓'s in the phrases of (3.2-11) may alternatively be pronounced as small drops in pitch. This variation in the size of a ↓ which is the last internal tone marker of a phrase shows that Phrase-final ↓ Deletion is an optional rule. Whether a speaker chooses to apply the rule or not depends on emphasis, and probably other stylistic variables as well. The rule of Phrase-final-↓Deletion, and its optionality, will be independently motivated in section (3.5) below.

3.3 The use of a pitch drop as a marker of syntactic structure: the proper name possessive. Certain syntactic environments in Igbo are marked with a drop in pitch which, I will argue, is a morpheme made up of a pitch drop marker only. This "syntactic" pitch drop can be seen between the two elements of each of the possessive phrases below:

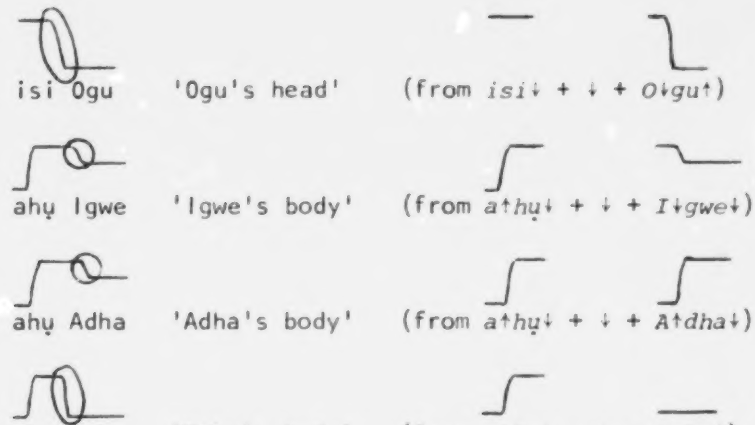
(3.3-1)



a. isi Chi 'Chi's head' (from *isi*↓ + ↓ + *Chi*↓)



b. isi Ekwe 'Ekwe's head' (from *isi*↓ + ↓ + *Ekwe*↓)



(3.3-1)

c. isi Ogu 'Ogu's head' (from *isi↓* + ↓ + *O↓gu↑*)

d. ahụ Igwe 'Igwe's body' (from *a↑hụ↓* + ↓ + *I↓gwe↓*)

e. ahụ Adha 'Adha's body' (from *a↑hụ↓* + ↓ + *A↑dha↓*)

f. ahụ Ugho 'Ugho's body' (from *a↑hu↓* + ↓ + *Ugho↑*)

Following established practice, I will call the tonal morpheme which marks this construction the "associative" morpheme. If we assume that the associative morpheme is not the final element of a phonological word, that is, if we assume that the phrases above have the word-boundary structure exemplified below:

(3.3-2) a. isi↓ # ↓ # Ekwe↓ (for 3.3-1 b)

b. a↑hụ↓ # ↓ # A↑dha↓ (for 3.3-1e)

then the rule of Like-Tone-Marker Deletion will not delete the associative ↓ even in phrases like (3.3-1a), (3.3-1b), and (3.3-1d), where the tone marker which most immediately succeeds it in the string is also a ↓. Consequently, the associative ↓ is a visible part of the surface tone contour of every possessive phrase.

The associative ↓ not only contributes its own pitch drop to the tone contour, but also affects the lexical tone contours of the elements on either side of it. In particular, it causes the deletion of all lexical tone markers which lie within a certain distance in either direction. For example, in the phrase whose underlying representation is given in (3.3-2b) above, it causes the deletion of the ↓ at the end of the head noun and the ↑ after the first syllable of the possessive noun phrase, thereby producing the surface tone contour *a↑hụ ↓Adha↓*.

The rule for the deletion of the internal tone marker of the word which lies to the right of the associative ↓ can be stated in the following way:

(3.3-3) Right Streamlining.

↓ (#) ([+syll])[+tone]

s.d. 1 2 3 4

s.c. Delete 4.

This rule deletes a tone marker which lies to the right of a ↓, separated from it by not more than a single word boundary and a syllabic segment. It is not necessary to specify that the controlling tone marker must be the associative↓ , for, as will be shown in Chapters VI and VII, the rule applies in the environment of any pitch drop. Notice that the rule deletes either a ↑ or a ↓. For example, it deletes the underlying (underlined) internal tone marker of each of the underlying strings below:

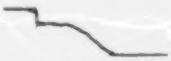
(3.3-4) a. a↑hụ↓ # ↓ # A$\underline{\uparrow}$dha↓ (3.3-1e)

b. isi↓ # ↓ # O$\underline{\downarrow}$gu↑ (3.3-1c)

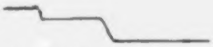
c. a↑hụ↓ # ↓ # I$\underline{\downarrow}$gwe↓ (3.3-1d)

The associative ↓ also causes the deletion of a lexical tone-marker to its immediate left. The examples of (3.3-1) illustrate the deletion of a ↓ from this position. However, a ↑ at the end of the head noun is also deleted, as can be seen from the phrases below:

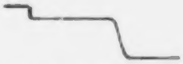
(3.3-5)



a. ụ ↓ lọ ↓ Chi ↓ 'Chi's house' (from ụ↓lọ↑ # ↓ # Chi↓)



b. ụ ↓ lọ ↓ Ekwe ↓ 'Ekwe's house' (from ụ↓lọ↑ # ↓ # Ekwe↓)



c. ụ ↓ lọ ↓ Ogu↑ 'Ogu's house' (from ụ↓lọ↑ # ↓ # O↓gu↑)

The deletion of a ↑ from the end of the head noun has a rather dramatic effect on the tone contour of the phrase, since it makes the final syllable of the head noun high-toned instead of low-toned.

The rule for the deletion of the tone marker to the left of the associative ↓ can be stated in the following way:

(3.3-6) Left Streamlining.

[+tone] (#) ↓

s.d. 1 2 3

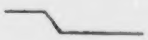
s.c. Delete 1.

Again, it is not necessary to specify that the controlling tone marker for this rule must be a morpheme; a ↓ which is part of the lexical representation of a word will also induce Left Streamlining, as will be shown in Chapter VI, section 3.

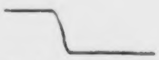
Together, the Streamlining rules delete any tone marker which lies within a specified distance to either side of the associative ↓. By eliminating lexically-introduced tone changes in the immediate vicinity of the associative morpheme, they simplify the tone contour and draw attention to the associative ↓ itself, which is an important marker of syntactic structure.

The application of the Streamlining rules is illustrated in the following derivations of the phrases of (3.3-1 b), (3.3-1 c), and (3.3-5 a)

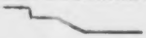
(3.3-7) a.

isi ↓ # ↓ # Ekwe↓	Underlying representation
	Right Streamlining, n.a.
Ø	Left Streamlining
↓	↓-Reduction
 isi ↓ Ekwe ↓	Output[10]

b.

isi ↓ # ↓ # O↓gu↑	Underlying representation
	Right Streamlining
Ø	Left Streamlining
	↓-Reduction, n.a.
 isi ↓ Ogu ↑	Output

c.

ụ↓lọ ↑ # ↓ # Chi↓	Underlying representation
Ø	Streamlining
↓ ↓	↓-Reduction
 ụ↓lọ ↓Chi↓	Output

Notice that the size of the associative pitch drop in each of these examples is accounted for by the independently-motivated rule of ↓-Reduction. Thus in (3.3-7 a) and (3.3-7 c), where the tone marker which most immediately succeeds the associative ↓ is a ↓, the rule of ↓-Reduction applies, reducing the associative ↓ to a small drop in pitch, but in (3.3-7 b), the tone marker which most immediately follows the associative ↓ is a ↑, and ↓-Reduction cannot apply.

The reader will probably have noticed that when the possessive noun phrase begins with a consonant, as in (3.3-1 a) and (3.3-5 a), the associative ↓ is realized as a falling glide on the final syllable of the head noun, rather than as a sharp drop in pitch between the two words of the phrase.[11] I propose to account for this fact by means of a convention that a tone marker in Igbo is realized as a gliding tone on the preceding syllable just in case (i) the tone marker and the syllable are inside the same phonological word, and (ii) the syllable is long. In general, a syllable will be long whenever there are two tone markers after it in the underlying form -- a situation which will arise only at the end of a word which is followed by a morphological tone marker such as the associative ↓, or by a word which begins with a tone marker. (There are just a few such words in Igbo.) The rule of Syllable Lengthening may be stated as follows:

(3.3-8) Syllable Lengthening.

[+syll][+tone](#)(#) ↓
s.d. 1 2 3 4 5
s.c. 1 > long

The reader will perhaps have noticed that rule (3.3-8) lengthens not only the final syllable of *ụ↓lọ↑* in (3.3-7 c), but also that final syllable of *isi↓* in (3.3-7 a) and (3.3-7 b). Why, then, is the associative ↓ not realized as a falling glide on the final syllable of *isi↓* in these examples? The answer is that there is a rule in Igbo, as in many other West African languages, which shortens an open syllable when the following syllable begins with a syllabic segment (as most words do in Igbo). The rule of Syllable Shortening may be stated as follows:

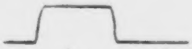
(3.3-9) Syllable Shortening.[12]

[+syll] (#) (#) [+syll]
s.d. 1 2 3 4
s.c. 1 > short

If the rule of Syllable Shortening is ordered after Syllable Lengthening, then it will undo the effect of that rule on any syllable which is immediately followed by a syllabic segment (as is the last syllable of *isi*↓ in (3.3-7 a) and (3.3-7 b)). Such a syllable will become too short to bear a gliding tone. Notice that the combined effect of the two rules is to create three contrasting syllable lengths -- (i) "long" syllables, which have undergone Syllable Lengthening, but not Syllable Shortening, (ii) "short" syllables, which have undergone Syllable Shortening, and (iii) syllables of intermediate length, which have not undergone either rule. Only long syllables are capable of bearing gliding tones in Igbo.

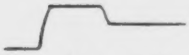
There is one additional tone change in the proper noun possessive which remains to be accounted for, and that is the fact that when the head noun is one like *ala*↑ 'land', which ends with a sequence of two or more low-toned syllables, its word-final ↑ is retracted one syllable, taking it out of the reach of Streamlining. Two examples of this phenomenon are given below, followed by a derivation of the first of them:

(3.3-10) a.



a ↑ la ↓ Ugho 'Ugho's land' (from *ala*↑ + ↓ + *Ugho*↑)

b.



a ↑ la ↓ Adha 'Adha's land' (from *ala*↑ + ↓ + *A*↑*dha*↓)

(3.3-11)

ala↑ # ↓ # Ugho↑	Underlying representation
↑ ← ∅	↑ -Retraction
	Streamlining, n.a.
	↓ -Reduction, n.a.
a ↑ la ↓Ugho ↑	Output

The rule of ↑ -Retraction which applies in the derivation above may be stated as follows:

(3.3-12) ↑ -Retraction

σ σ ↑ (#) ↓

s.d. 1 2 3 4 5 s.c. Transpose 2 and 3

This rule states that a ↑ is retracted from the end of a word when there is a ↓ (such as the associative ↓) immediately after it, and when the preceding syllable boundary is not already occupied by a tone marker. (This condition is established by including term 1 in the structural description of the rule.) ↑ -Retraction must be ordered before Left Streamlining, since a ↑ which meets the structural description of both rules is retracted, and not deleted. Notice that the ↑ -Retraction process provides additional evidence for the presence of a ↑ at the end of a word which ends on a low tone level.

That completes our account of the tonal properties of proper noun possessives in Igbo. The rules which have been proposed so far in this analysis are repeated below, in the order in which they must apply:

(3.3-13) a. *Syllable Lengthening* (repeated from (3.3-8))

	[+syll]	[+tone]	(#)	(#)	↓
s.d.	1	2	3	4	5

s.c. Make 1 long.

b. *Syllable Shortening* (repeated from (3.3-9))

	[+syll]	(#)	(#)	[+syll]
s.d.	1	2	3	4

s.c. Make 1 short.

c. *Right Streamlining* (repeated from (3.3-3))

	↓	(#)	([+syll])	[+tone]
s.d.	1	2	3	4

s.c. Delete 4.

d. *↑-Retraction* (repeated from (3.3-12))

	σ	σ	↑	(#)	↓
s.d.	1	2	3	4	5

s.c. Transpose 2 and 3.

e. *Left Streamlining* (repeated from (3.3-6))

	[+tone]	(#)	↓
s.d.	1	2	3

s.c. Delete 1.

(3.3-13) f. Phrase-final ↓ Deletion (repeated from (3.2-9))

$\downarrow \rightarrow \emptyset$ / ___ \$

Condition: Optional

g. Like-Tone-Marker Deletion (repeated from (3.2-3))

$$\begin{bmatrix} +\text{tone} \\ <+\text{fall}> \end{bmatrix} <\#\#> \ \ldots \ \begin{bmatrix} +\text{tone} \\ <+\text{fall}> \end{bmatrix} \ \ldots \ \$\$$$

s.d. 1 2 3 4 5 6, where 3 contains no tone markers

s.c. 1 > Ø

h. ↓-Reduction (repeated from (3.2-5))

↓ ... ↓ ... \$\$

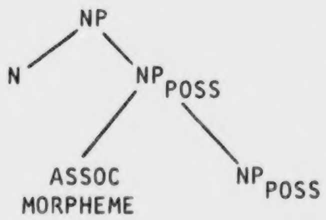
s.d. 1 2 3 4 5, where 2 contains no tone markers.

s.c. Reduce the magnitude of 1 by two thirds.

3.4 The common-noun possessive. In the previous section, I argued that the proper noun possessive in Igbo is marked with an associative morpheme which consists of a drop in pitch only. Besides being part of the tone contour of the phrase, the associative pitch drop also brings about certain changes in the tone contour of the adjacent string. In particular, it may cause the retraction of a ↑ which would otherwise come right before it, and it also causes the deletion of nearby tone markers on either side, a process which I have called "Streamlining".

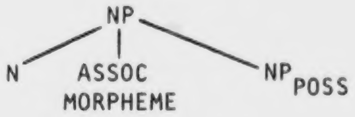
The common noun possessive (in which the head of the possessive noun phrase is a common noun) is like the proper noun possessive in having an associative pitch drop between its two elements, but the position of the pitch drop, the manner of its realization, and its effect on the surrounding tone contour are somewhat different in the two constructions. In the section which follows, I will examine four differences between the proper noun possessive and the common noun possessive and will show that all four of these differences follow naturally from a slight difference in the syntactic position of the associative morpheme in the two constructions. In particular, I will argue that in the common noun possessive, the associative ↓ has cliticized to the possessive noun phrase, so that the phrase as a whole has the structure shown below.

(3.4-1)



However, in the proper noun possessive, the associative ↓ does not cliticize to the possessive noun phrase, and the phrase as a whole has the following structure:

(3.4-2)



If we assume that a short grammatical element like the associative morpheme is separated by only a weak (single) word boundary from adjoining constituents which are sisters to it, then the distinct syntactic structures of these two constructions will be carried over into their word-boundary structures, as shown below:

(3.4-3) a. Proper noun possessive.

... # ↓ # ...

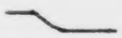
b. Common noun possessive.

... ## ↓ # ...

The structural difference which is hypothesized here can be expected to have an effect on the application of the various tonal processes which apply to, and in the environment of, the associative ↓. I will argue below that the tonal properties which distinguish these two constructions from one another follow in a natural way from the structural difference proposed above.

The first difference between the common noun and proper noun possessives is in the way in which the associative pitch drop is pronounced when the possessive noun phrase begins with a consonant. As we saw in the preceding section, when the possessive noun phrase is a proper noun beginning with a consonant, the associative ↓ is realized as a falling glide on the head noun, as in

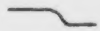
(3.4-4)



isi↓Chi↓ 'Chi's head'

In contrast, in a common noun possessive in which the possessive noun phrase begins with a consonant, the associative ↓ is realized as a sharp drop in pitch at the constituent boundary, as in

(3.4-5)



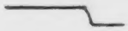
isi↓ji↓ (from *isi*↓ + ↓ + *ji*↓)

'the top of a yam' 'head' 'yam'

The difference in the realization of the associative ↓ in these two cases can be attributed to the difference in the structure of the two phrases, since if the associative ↓ has cliticized to the possessive noun phrase in (3.4-5), but not (3.4-4), then the associative marker of (3.4-4) is part of the same phonological word as *isi*↓, while that of (3.4-5) is not. It is generally the case in languages with lexical tone that a tone marker is not realized as a gliding tone on a syllable which is not in the same phonological word with it. (See the discussion in Chapter 1, section 3.)

A second difference between the common and proper noun possessives in Igbo is that in the former, but not in the latter, the associative ↓ is moved to a position following the first syllable of the possessive noun phrase when that syllable consists of a high-toned vowel only. Contrasting examples are given below:

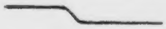
(3.4-6) a. Common noun possessive.



isi e↓γu↓ (from *isi*↓ + ↓ + *eγu*↓)

'a goat's head' 'head' 'goat'

b. Proper noun possessive.



isi ↓ Ekwe ↓ (from *isi*↓ + ↓ + *Ekwe*↓)

If these phrases have the underlying structures shown in (3.4-1) and (3.4-2), then we can account for the surface position of the associative ↓ of (3.4-6 a) by means of the rule below:[13]

(3.4-7) ↓-Metathesis.

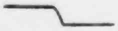
$_{NP}[\downarrow[+\text{syll}] \ \ldots \ \downarrow$

s.d. 1 2 3 4, where 3 contains no tone markers.

s.c. Transpose 1 and 2.

This rule does not apply to the proper noun possessive of (3.4-6 b) because the associative ↓ of this construction is not part of the possessive noun phrase. The condition that the tone marker which most immediately follows term 1 must also be a ↓ is necessary in order to account for the fact that even in a common noun possessive the associative ↓ does not move to the right of the initial syllabic segment of the possessive noun phrase if that segment is low-toned,[14] as in the example below:

(3.4-8)

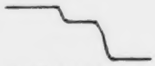


isi↓oke↓ (from *isi↓* + ↓ + *o↑ke↓*)

'the head of a rat' 'head' 'rat'

↓-Metathesis also does not apply when the possessive noun phrase begins with a consonant, as in

(3.4-9)



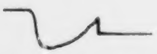
isi↓dị↓bya↑ (from *isi↓* + ↓ + *dị↓bya↑*)

'the head of a doctor' 'head' 'doctor'

This fact is included in the description of the rule.

We have now seen two ways in which the common noun possessive in Igbo differs tonally from the proper noun possessive. A third difference between the two possessives is that ↑-Retraction and Streamlining do not apply in the common noun possessive when the possessive noun phrase begins with a consonant. Thus there is a rising glide at the end of the head noun in each of the phrases below:

(3.4-10) a.



ọ↓dhụ↑↓ji↓ (from *ọ↓dhụ↑* + ↓ + *ji↓*)

'the bottom of the yam' 'bottom' 'yam'

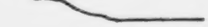
b.

mkpa↑↓ji↓ (from *mkpa↑* + ↓ + *ji↓*)

'the stick of the yam' 'stick' 'yam'

The phrases above contrast with the corresponding proper name possessives, in which a ↑ before the associative ↓ is always either deleted or retracted, and the associative ↓ is then realized as a gliding tone on the final syllable of the head noun. These properties of the proper noun possessive are illustrated below:

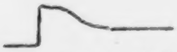
(3.4-11) a.



ụ ↓ lọ ↓ Chi ↓ (from *ụ↓lọ↑* + ↓ + *Chi↓*)

'Chi's house' 'house'

b.



a ↑ la ↓ Chi (from *ala↑* + ↓ + *Chi↓*)

'Chi's land' 'land'

The difference in the applicability of ↑-Retraction and Streamlining in these two constructions arises naturally from the assumption that the associative morpheme ↓ cliticizes to the possessive noun phrase only in the common noun possessive, for given that assumption, the phrases of (3.4-10) and (3.4-11) must have the underlying structures shown below:

(3.4-12) a. ọ↓dhụ↑##↓# ji↓

b. mkpa↑##↓# ji↓

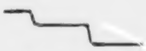
c. ụ↓lọ↑ #↓# Chi↓

d. ala↑ #↓# Chi↓

It is reasonable that ↑-Retraction and Streamlining should apply in (c) and (d), but not in (a) and (b), because the associative ↓ is separated from the target ↑ by a greater syntactic distance in (a) and (b) than in (c) and (d).

The fact that ↑-Retraction and Streamlining do not apply in (3.4-10) cannot be attributed entirely to the word-boundary structure of these phrases, however, because these rules do apply in common noun possessives in which the possessive noun phrase begins with a vowel. For example, the ↑ at the end of *ọ↓dhụ↑* in the common noun possessive below is deleted in the environment of the associative ↓:

(3.4-13)

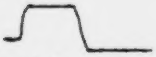


ọ↓dhụ↓oke↓ (from *ọ↓dhụ↑* + ↓ + *o↑ke↓*)

'the tail of a rat' 'tail' 'rat'

Similarly, in the common noun possessive below, the underlying ↑ of *abha↑* has been retracted before the associative ↓:

(3.4-14)



a↑bha↓eŋwo↑ (from *abha*↑ + ↓ + *eŋwo*↑)

'the jaw of a monkey' 'jaw' 'monkey'

We can see why the rules of ↑-Retraction and Streamlining apply to the phrases of (3.4-13) and (3.4-14), but not to those of (3.4-10 a) and (3.4-10 b) if we recall that the syllable at the end of a word is shortened when the word which follows it begins with a vowel. Apparently ↑-Retraction and Streamlining will apply across a strong word boundary when the syllable on the other side of the affected tone marker is short, but not when it is long. These rules will apply correctly in every case if we re-state them as follows:

(3.4-15) a. ↑-Retraction.

σ σ ↑ (# (#)) ↓

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3

Condition: If 5 is present, then 2 is not long.

b. Left Streamlining.

σ [+tone] (# (#)) ↓

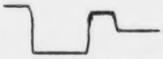
s.d. 1 2 3 4 5

s.c. 2 > 0

Condition: If 4 is present, then 1 is not long.

Notice that ↑-Retraction and Streamlining do not apply when ↓-Metathesis has moved the associative ↓ inside the possessive noun phrase. Thus the final ↑'s of *ụ↓lọ*↑ and *abha*↑ remain in place in the examples below:

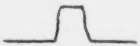
(3.4-16) a.



ụ↓lọ↑ e↓γu↓ (from *ụ↓lọ*↑ + ↓ + *eγu*↓)

'goat shed' 'house' 'goat'

b.



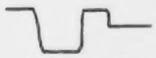
ala↑ m↓be↑ (from *ala*↑ + ↓ + *m↓be*↑)

'land of tortoises' 'land' 'tortoise'

I have argued above that three tonal differences between the common noun possessive and the proper noun possessive in Igbo follow naturally from the assumption that the associative marker, ↓, is cliticized to the possessive noun phrase in the common noun possessive, but not in the proper noun possessive. There is one other tonal difference between these two constructions, and it can be accounted for in the same way. This difference has to do with the special tonal properties of common noun possessives in which the possessive noun phrase begins with a syllabic nasal which is followed by a nasal consonant. The facts which I give below are from Welmers (1968) and Ward (1936), and have been checked with my informant, Dr. Nonyelu Nwokoye, a native of Awka.

Recall that in Central Igbo, a common noun possessive undergoes ↓-Metathesis only if the first syllable of the possessive noun phrase is a high-toned syllabic segment. Thus ↓-Metathesis applies in the first of the phrases below, but not in the second:

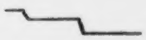
(3.4-17) a.



ụ↓lọ↑e↓γu↓ (from *ụ↓lọ↑* + ↓ + *eγu↓*)

'goat shed' 'house' 'goat'

b.

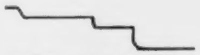


ọ↓dhụ↓oke↓ (from *ọ↓dhụ↑* + ↓ + *o↑ke↓*)

'the tail of a rat' 'tail' 'rat'

In contrast, when the possessive noun phrase begins with a syllabic nasal which is followed by a nasal consonant,[15] the associative ↓ moves to the right even when the syllabic nasal is low-toned, as in

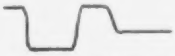
(3.4-18)



ụ↓lọ m↓ma↓dhụ↑ (from *ụ↓lọ↑* + ↓ + *m↑ma↓dhụ↑*)

'a man's house' 'house' 'man'

The position of the associative ↓ in (3.4-18) might be accounted for by means of a condition on the rule of ↓-Metathesis (3.4-7), so that it would apply to a noun phrase beginning with a syllabic nasal even if that syllabic nasal were low-toned. However, there are facts which indicate that this is not the correct solution. Notice that the rule of Left Streamlining has applied in (3.4-18), deleting the ↑ at the end of *ụ↓lọ↑* in the environment of the associative ↓. This rule does not ordinarily apply when the possessive noun phrase begins with a high-toned syllabic segment, nor does it apply when the possessive noun begins with a syllabic nasal which is underlyingly high-toned, as in[16]

(3.4-19) 

ụ↓lọ↑ m↓mụọ↓ (from *ụ↓lọ↑* + ↓ + *mmụ↓ọ↓*)

'house of spirits' 'house' 'spirits'

This difference in the two examples of (3.4-18) and (3.4-19) suggests that only in the former has the associative ↓ been moved to the right by the rule of ↓-Metathesis, which precedes Left Streamlining. The surface position of the associative ↓ of (3.4-19) must be accounted for by means of a second metathesis rule, which is ordered after the Streamlining rules, and which may be stated as follows:

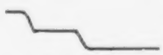
(3.4-20) Syllabic Nasal Raising.

$$\begin{array}{lcccc} & \#\# & [+\text{tone}] & \begin{bmatrix}+\text{syll}\\+\text{nas}\end{bmatrix} & [+\text{nas}] \\ \text{s.d.} & 1 & 2 & 3 & 4 \end{array}$$

s.c. Transpose 2 and 3.

This rule takes a tone marker at the beginning of a phonological word and transposes it with the following syllabic nasal if the syllabic nasal is, in turn, followed by a nasal consonant. (Note that any tone marker which lies between the syllabic nasal and the nasal consonant in underlying representation will have been deleted previously, by the rule of Right Streamlining.)

If the rule of Syllabic Nasal Raising is stated correctly, and if our assumption that the associative ↓ does not cliticize to the possessive noun phrase in proper noun possessives is correct, then proper noun possessives should not undergo Syllabic Nasal Raising. That prediction is correct, as can be seen from the example below:

(3.4-21) 

ụ↓lọ↓ Nne↓ (from *ụ↓lọ↑* + ↓ + *N↑ne↓*)

'Mother's house' 'house' 'Mother'

In summary, we have found four differences between the common noun possessive and the proper noun possessive. These are outlined in the chart below:

(3.4-22)

	Common Noun Possessive	Proper Noun Possessive
a.	The associative ↓ is always realized as a sharp drop in pitch.	When the possessive noun phrase begins with a consonant, the associative ↓ is realized as a falling glide on the final syllable of the head noun.
b.	If the first syllable of the possessive noun phrase is a high-toned syllabic segment, then the associative ↓ moves to the right of that segment.	The associative ↓ always lies between the two elements of the construction, even when the possessive noun phrase begins with a high-toned syllabic segment.
c.	When the possessive noun phrase begins with a consonant, a ↑ at the end of the head noun is allowed to remain, and is realized as a rising glide on the final syllable of the head noun.	A ↑ at the end of the head noun is deleted or retracted even when the possessive noun phrase begins with a consonant.
d.	If the possessive noun phrase begins with a syllabic nasal followed by a nasal consonant, then the associative ↓ is transposed with the syllabic nasal even if it is underlyingly low-toned.	The associative ↓ lies between the two elements of the construction even when the possessive noun phrase begins with a syllabic nasal followed by a nasal consonant.

These four differences between the common and proper noun possessives follow naturally from the assumption that in the common noun possessive the associative ↓ has cliticized to the possessive noun phrase, while in the proper noun possessive it has not. This assumption accounts for difference (a) above between the two constructions, because it is typically the case in languages with lexical tone that a tone marker at the beginning of a phonological word is not realized as a gliding tone on the preceding syllable even when that syllable is long. The assumed difference in structure is also important in accounting for differences (b) and (d), because the transposition of a tone marker with the syllable which follows it may be expected to occur more readily within a phonological word than across word boundaries. Finally, the assumed difference in structure helps to account for difference (c), because it is reasonable to expect that rules which retract or delete one tone marker in the environment of another should apply more readily across a single word boundary (as in the proper noun possessive) than across double word boundaries (as in the common noun possessive.)

The rules which have been motivated so far for Igbo are repeated below, in the order in which they must apply:

(3.4-23) a. ↓-Metathesis (repeated from (3.4-7))

$_{NP}[\downarrow[+\text{syll}]\ldots\downarrow$

s.d. 1 2 3 4, where 3 contains no tone markers

s.c. Transpose 1 and 2.

b. Syllable Lengthening (repeated from (3.3-8))

$[+\text{syll}][+\text{tone}](\#)(\#)\downarrow$

s.d. 1 2 3 4 5

s.c. Make 1 long.

c. Syllable Shortening (repeated from (3.3-9))

$[+\text{syll}]\ (\#)\ (\#)\ [+\text{syll}]$

s.d. 1 2 3 4

s.c. Make 1 short.

d. Right Streamlining (repeated from (3.3-3))

$\downarrow\ (\#)\ ([+\text{syll}])\ [+\text{tone}]$

s.d. 1 2 3 4

s.c. Delete 4.

e. ↑-Retraction (repeated from (3.4-15 a))

$\sigma\ \sigma\ \uparrow\ (\#)\ (\#)\ \downarrow$

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

Condition: If 4 and 5 are both present, then 2 is long.

(3.4-23) f. Left Streamlining (repeated from (3.3-6))

σ [+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Delete 2.

Condition: If 4 and 5 are both present, then 1 is not long.

g. Syllabic-Nasal Raising (repeated from (3.4-20))

$$\#\# \quad [+\text{tone}] \begin{bmatrix}+\text{syll}\\ +\text{nas}\end{bmatrix} [+\text{nas}]$$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

h. Phrase-final ↓ Deletion (repeated from (3.2-9))

↓ → Ø / ____ $

Condition: Optional

i. Like-Tone-Marker Deletion (repeated from (3.2-3))

$$\begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} <\#\#> \quad \ldots \begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} \quad \ldots \quad \$\$$$

s.d. 1 2 3 4 5 6

s.c. Delete 1.

Condition: 3 contains no tone markers.

j. ↓-Reduction (repeated from (3.2-5))

↓... ↓... $$

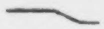
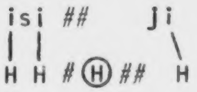
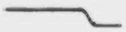
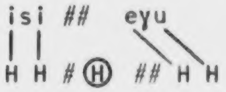
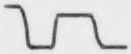
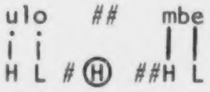
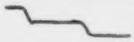
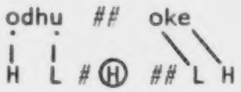
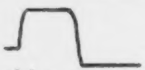
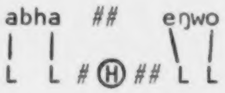
s.d. 1 2 3 4 5

s.c. Reduce the magnitude of 1 by two thirds.

Condition: 2 contains no tone markers.

3.5. On the analysis of the Igbo possessive construction in an autosegmental level-tone theory. Linguists who have analyzed Igbo in level-tone terms have considered the associative morpheme which appears in the possessive construction to be a high tone rather than a pitch drop. In an analysis of this sort, the possessive phrases below are assumed to have the underlying structures shown, where the circled high tone is the associative marker:

(3.5-1)

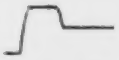
	Surface Tone Contour	Underlying Representation
a.	 isi ji H H 'H 'the top of the yam'	 isi ## ji H H #Ⓗ## H
b.	 isi eỵu H H H'H 'the head of a goat'	 isi ## eỵu H H #Ⓗ ## H H
c.	 ụlọ mbe H L H L 'the house of a tortoise'	 ụlọ ## mbe H L #Ⓗ ##H L
d.	 ọdhụ oke H 'H 'H 'the tail of a rat'	 ọdhụ ## oke H L #Ⓗ ## L H
e.	 abha eŋwo L H L L 'the jaw of a monkey'	 abha ## eŋwo L L #Ⓗ## L L

Goldsmith (1976) has proposed the following rule to account for the lowering of a high tone to downstepped high in possessive noun phrases like (a) and (b) above:

(3.5-2) $[+\text{tone}] \rightarrow [-\text{high}] \;/\; [\text{H}]_{\text{Af}}\ \#\#\ X\ \_\_\_\ \#$

The $[\text{H}]_{\text{Af}}$ which appears in the structural description of this rule is the associative morpheme. In Goldsmith's framework, where $\text{H} = \begin{bmatrix}+\text{high}\\ -\text{low}\end{bmatrix}$, $'\text{H} = \begin{bmatrix}-\text{high}\\ -\text{low}\end{bmatrix}$, and $\text{L} = \begin{bmatrix}-\text{high}\\ +\text{low}\end{bmatrix}$, what rule (3.5-2) does is to lower a high tone to downstepped high at the end of a word which is preceded by the associative morpheme. The rule gives the correct results for the examples of (3.5-1 a) and (3.5-1 b) above, but not for possessive noun phrases in which the first word is a bi-syllabic noun beginning with a consonant. Nouns of this sort, which include *manụ* 'oil' (HH), *maỹa* 'wine' (HH), *madhụ* 'person' (HL), and *dịbya* 'doctor' (HL), get their downstepped high tone on the first syllable rather than the last, as can be seen from the examples below:

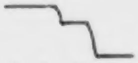
(3.5-3) a.



iko maỹa (from *iko* + Ⓗ + *maỹa*)

'wine cup' L H H H

b.



isi dịbya (from *isi* + Ⓗ + *dịbya*)

'the head of a doctor' H H H L

What makes the difference here is whether the possessive noun begins with a syllabic segment or a consonant; in other words, the generalization is that the first CV syllable of the possessive noun gets [-high] tone. Thus rule (3.5-2) must be amended to

(3.5-4) a. $$[+\text{tone}] \rightarrow [-\text{high}] \;/\; [\text{H}]_{\text{Af}}\ \#\#\ \left(\begin{array}{c}\text{V}\\ |\\ [+\text{tone}]\end{array}\right)\ \_\_\_$$

To account for the smoothing out of the tone contour of the possessive noun in phrases like *ọdhụ oke* 'the tail of a rat' (3.5-1 d), Goldsmith proposes a second rule, which he states as follows:

(3.5-5) $[+\text{low}] \rightarrow \emptyset \;/\; [\text{H}]_{\text{Af}}\ \#\#\ \_\_\_$

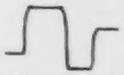
This rule accounts for the tone contour of $\underset{\text{L H}}{\textit{oke}}$ in the phrase $\underset{\text{H 'H}}{\textit{\d{o}dh\d{u}}}$ $\underset{\text{'H}}{\textit{oke}}$ in the following way: First the H of $\underset{\text{L H}}{\textit{oke}}$ is lowered to 'H by rule (3.5-4). Then rule (3.5-5) deletes the L of *oke* and, by the convention that every syllable must be associated with a tone segment, the now toneless *o* is also associated with the 'H. This much of the derivation of the phrase *ọdhụ oke* is shown below:

```
(3.5-6)  a.  ọdhụ #    ## oke          by rule (3.5-4)
             |  |         | |        ══════════════════>
             H  L # Ⓗ ## L H

         b.  ọdhụ #    ## oke          by rule (3.5-5)
             |  |         | \        ══════════════════>
             H  L # Ⓗ ## L 'H

         c.  ọdhụ #    ## oke
             |  |          \|
             H  L # Ⓗ ##   'H
```

The remainder of the derivation of this phrase will be given in (3.5-10)-(3.5-12), below.

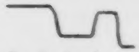
Goldsmith's rule (3.5-5), like his rule (3.5-2) gives the wrong result for a possessive noun which begins with a consonant, as in the examples below:

(3.5-7) a.



```
iko gari                      (from iko + Ⓗ + gari)
                                    | |          | |
'a cup of cassava meal'             L H          L H
```

b.



```
isi bekee                     (from isi + Ⓗ + bekee)
                                    | |          | ||
'the head of a white man'           H H          L HL
```

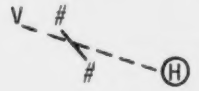
So that rule (3.5-5) will not delete the initial low tone of the possessive noun phrase in the examples above, we must revise the statement of that rule to the following:

(3.5-8)

$$[+\text{low}] \rightarrow \emptyset \;/\; [\text{H}]_{\text{Af}}\ \#\#\ \underline{\overset{\text{V}}{|}}$$

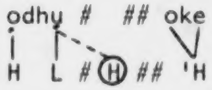
Now consider the tone change which takes place on the left-hand side of the associative marker, whereby a low-toned syllable at the end of the head noun is raised to downstepped high (as in (3.5-1d) and (3.5-1 e)). Goldsmith accounts for this tone change by means of the "docking" rule, shown below, which attaches the associative marker to the final syllable of the head noun:

(3.5-9)



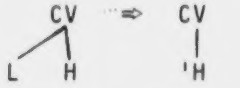
The dotted line represents the structural change, and the circle around the H indicates that this is a "floating" high tone -- specifically, the associative morpheme. Rule (3.5-9) applies to the intermediate form (3.5-6 c) above, attaching the associative morpheme to the final syllable of *ọdhụ*, as shown below:

(3.5-10)



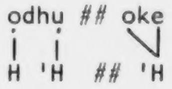
Finally, the tone simplification rule shown below applies, changing the rising glide to a downstepped high:

(3.5-11)



This rule applies to the intermediate string to (3.5-10) to create the output string

(3.5-12)



(I assume an automatic simplification of the word-boundary structure with the loss of the associative marker.)

Two additions are needed to complete this analysis of the common noun possessive in Igbo. First, it is necessary to account for the fact that the final low tone of *ụlọ* 'house' is not raised

H L

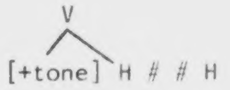
to 'H in phrases like *ụlọ mbe* 'the house of a tortoise' (3.5-1 c),

H L H L

in which the possessive noun begins with a high tone. Secondly, it is necessary to say something about the downstepped high tone itself, and how it gets its phonetic realization.

To account for the fact that the low tone at the end of the head noun is not raised to downstepped high before a high tone, Goldsmith introduces the rule shown below:

(3.5-13)



s.d. 1 2 3 4 5

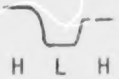
s.c. 2 > 0

This rule deletes a high tone which has "docked" onto a preceding syllable when the following word begins with a high tone. If this rule is ordered before the tone-simplification rule of (3.5-11), then it will correctly delete the high tone-segment in phrases like *ụlọ mbe*. Finally, Goldsmith introduces a convention for the

H L Ⓗ H L

realization of the downstepped high tone. Noting that Igbo is subject to "downdrift", whereby a HLH tone sequence is pronounced

(3.5-14)

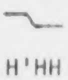


with the second high tone segment lower in pitch than the first, Goldsmith reasons that Igbo must contain the following convention:

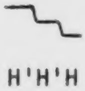
(3.5-15) Lower the high tone register whenever a [-high] tone follows a [-low] tone.

This convention lowers the high tone register between the first and second tone segments of (3.5-14), thereby accounting for the fact that the second high tone of this contour is somewhat lower in pitch than the first. However, if the tone levels H, 'H, and L are given the feature specifications $\begin{bmatrix}+\text{high}\\-\text{low}\end{bmatrix}$, $\begin{bmatrix}-\text{high}\\-\text{low}\end{bmatrix}$, and $\begin{bmatrix}-\text{high}\\+\text{low}\end{bmatrix}$ respectively, and if all [-low] tones are pronounced on the high tone register, then convention (3.5-15) will account for the pronunciation of the downstepped high tone as well. Thus, for example, the three tone segments of the string

(3.5-16)



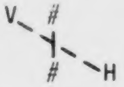
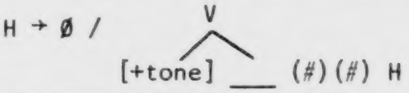
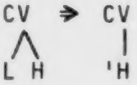
are all, in this view, pronounced on the high tone register. The drop in pitch between the first two segments is a change in the high tone register itself, brought about by the convention of (3.5-15) which lowers the high tone register between the initial H ([-low]) segment and the 'H ([-high]) segment which follows it. Similarly, the three tone segments of the string

(3.5-17) 

are all pronounced on the high tone register, but this time the high tone register is lowered twice -- once between the high tone segment and the first downstepped high, and again between the two downstepped highs.

The rules and conventions which have been introduced here to account for the Igbo common noun possessive within the autosegmental theory are listed below. In comparing this analysis with the dynamic-tone analysis summarized in (3.4-23), the reader should keep in mind that the analysis below does not include an account of the special tonal behavior of possessive noun phrases which begin with syllabic nasals, nor does it include an account of proper noun possessives or of phrase-final lowering.

(3.5-18)

a.	$[+\text{tone}] \rightarrow [-\text{high}] \;/\; [\text{H}]_{\text{Af}}\ \#\#\ \begin{pmatrix}\text{V}\\ [+\text{tone}]\end{pmatrix}\ \_\_\_$
b.	$\text{L} \rightarrow \emptyset \;/\; [\text{H}]_{\text{Af}}\ \ \#\#\ \ \underset{\_\_\_}{\overset{\text{V}}{\mid}}$
c.	
d.	
e.	
f.	The high tone register is lowered whenever a [-low] tone is immediately followed by a [-high] tone.

Rule (a) above accounts for the downstep on the first CV-syllable of the possessive noun in a phrase like *isi eɣu* 'the head of a goat'.
H H H'H

Rule (b) accounts for the smoothing out of the tone contour of the

of the possessive noun in phrases like *isi oke* 'the head of a rat'
H H 'H
(from *isi* + H + *oke*). Rules (c) and (e) together account for the
H H L H
raising of the low tone at the end of a head noun in a phrase like
odhụ oke 'the tail of a rat' (from *odhụ* + H + *oke*). Rule (d)
Ḣ 'Ḣ 'H Ḣ L̇ L H
accounts for the fact that this last tone change does not take place when the possessive noun phrase begins with a high tone, as in *ụlọ eγụ* 'goat shed'. Finally, convention (f) ensures the proper
Ḣ L̇ H'H
pronunciation of the downstepped high tone, while also accounting for downdrift.

This autosegmental analysis of Igbo is unsatisfactory in several ways. First, and most important, the two rules (a) and (b), which prescribe certain tone changes in the word which follows a high tone affix, are quite arbitrary in their effect, for there is nothing in the nature of a floating high tone affix which would lead us to expect it to induce these particular changes in the tone contour of the adjacent string. If a floating high tone can bring about these changes, then it will be difficult to say what changes it could not bring about. This is in contrast to the dynamic-tone analysis, in which the tone changes brought about by the associative marker (↓) consist only of the retraction of a preceding ↑ and the deletion of other nearby tone markers -- changes which are natural consequences of the insertion of an "extra" tone marker into the string.

A second difficulty with the autosegmental analysis above is that it is not easily extended to cover the proper noun possessive. Goldsmith himself does not propose an analysis of the proper noun possessive, but Voorhoeve, Meeussen and deBlois (1969), who take a similar approach, have suggested that the special tonal properties of this construction can be accounted for by means of a rule lowering the first syllable of the possessive noun phrase when it is a proper name beginning with a syllabic segment. Such a rule would produce the correct output for phrases like the following:

(3.5-19) isi Ekwe 'Ekwe's head' (from *isi*, *Ekwe*)
| | \/ H H H H
H H 'H

because *Ekwe* would, by the rule proposed, become *Ekwe*, and rules
H H L H
(3.5-18 a) and (3.5-18 b) would then apply to give it 'H tone. (See the derivation of (3.5-6), which parallels this one.) However, the rule proposed by Voorhoeve, Meeussen and deBlois does not account for the difference in the following examples, where

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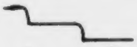
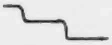
the possessive noun phrase begins with a syllabic nasal.

(3.5-20) a. Common Noun Possessive.



ụlọ mmaỹa 'bar' (*ụlọ* 'house', *mmaỹa* 'wine')
| | | | | H L L H H
H'H H'H H

b. Proper Noun Possessive.

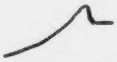


ụlọ Nne 'Mother's house' (*ụlọ* 'house', *Nne*
| | \/ H L L H
H'H 'H 'mother')

Nor does it account for the difference in phrases like the following, in which the possessive noun phrase begins with a consonant:

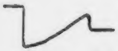
(3.5-21) Common Noun Possessive.

a.



mkpa ji 'stick of yams' (*mkpa* 'stick', *ji* 'yams')
| /\ | L L H
L LH 'H

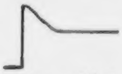
b.



ọdhụ ji 'bottom of the yam' (*ọdhụ* 'bottom')
| /\ | H L
L LH 'H

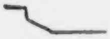
(3.5-22) Proper Noun Possessive.

a.



ala Chi 'Chi's land' (*ala* 'land', *Chi*)
| /\ | L L H
L H'H H

b.



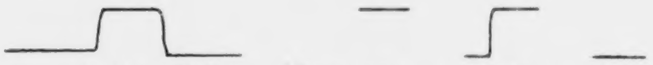
ụlọ Chi 'Chi's house' (*ụlọ* 'house', *Chi*)
| /\ | H L H
H'H'H H

Finally, Goldsmith's treatment of the downstepped high tone, while attractive for Igbo, cannot be extended to Kikuyu, which, according to Clements and Ford (1977), also makes use of a downstep as a marker of syntactic structure. The tonal system of Kikuyu will be discussed below in section 4.

3.6 Pre-clause Lowering. We have seen above that the dynamic-tone theory allows a particularly natural and direct account of the tonal properties of possessive phrases in Igbo, which are characterized by the introduction of a pitch drop between the two constituents of this construction and the deletion or retraction of any pitch change which would otherwise lie "too near" the inserted ↓. Four differences in the tonal properties of common and proper noun possessives have been shown to follow naturally from a difference in the syntactic position of the associative marker in the two constructions.

There is one other part of the tonal system of Igbo which strongly supports a dynamic representation of tone, and that is the phenomenon which I will call pre-clause lowering, whereby a string of high-toned syllables before a clause is lowered when the clause which follows it begins on a low tone-level. For example, in head position before a relative clause which begins with a low-toned syllable, a HH noun like *eɣu↓* becomes LL, a H'H noun like *e↓go↓* becomes HL, and a LH noun like *o↑ke↓* becomes LL. Some examples are given below:

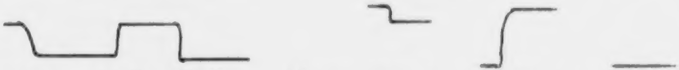
(3.6-1) a.



eɣu A↑dha ↓h̃ụr̃ụ↑ (from *eɣu↓* + *A↑dha↓* + *h̃ụr̃ụ↑*)

'the goat Adha saw' 'goat' 'saw'

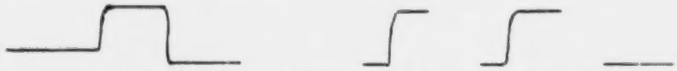
b.



e↓go A↑dha h̃ụr̃ụ↑ (from *e↓go↓* + *A↑dha↓* + *h̃ụr̃ụ↑*)

'the money Adha saw' 'money'

c.



oke A↑dha ↓h̃ụr̃ụ↑ (from *o↑ke↓* + *A↑dha↓* + *h̃ụr̃ụ↑*)

'the rat Adha saw' 'rat'

These facts can be accounted for in a level-tone theory by means of a rule lowering a string of high tones before a clause which begins with a low-toned syllable. For example, Goldsmith (1976) proposes the following rule:

(3.6-2) Disjoint Tonal Sandhi.

$H \rightarrow L \,/\, \_\_\; X[_S\; L$, where X contains no [-high] tone and no *##*.

However, it is puzzling, one feels, that the language should contain such a rule. Goldsmith suggests that the rule exists "to help make clear the grammatical relation between the Head NP and the Subject NP--to wit, none", but it is at least unusual to find a sandhi rule applying between elements which are not grammatically related rather than between elements which are. Thus it is an advantage of the dynamic-tone theory that it allows these facts to be accounted for by independently-motivated rules if we only assume that there is a phrase boundary ($) between a head noun and the relative clause which follows it. If this assumption is correct, then the phrases of (3.6-1) have the structure shown below:

(3.6-3) a. eɣu ↓ $ A↑dha ↓h̃ụr̃ụ↑

b. e↓go↓ $ A↑dha ↓h̃ụr̃ụ↑

c. o↑ke↓ $ A↑dha ↓h̃ụr̃ụ↑

The rule of Phrase-final- ↓ Deletion, which is needed in any case in order to account for phrase-final lowering, applies to the underlying structures of (3.6-3), deleting the lexical ↓ at the end of the head noun in each case, and producing the following intermediate strings:

(3.6-4) a. eɣu $ A↑dha ↓h̃ụr̃ụ↑

b. e↓go $ A↑dha ↓h̃ụr̃ụ↑

c. o↑ke $ A↑dha ↓h̃ụr̃ụ↑

Phrases (a) and (b) above are now in their correct output form; with its final ↓ gone, the noun *eɣu↓* (a) is necessarily pronounced on the same low tone level as the first syllable of *A↑dha↓*, as is the final syllable of *e↓go↓* in (b). The internal pitch drop of *e↓go↓* does not undergo ↓-Reduction, as it normally would, because the tone marker which most immediately succeeds it in the string is now a ↓. Phrase (c) above has one more change to undergo--the deletion of the ↑ of *o↑ke↓*--but this change is accomplished by means of the already-existing rule of Like-Tone-Marker Deletion (3.4-23i), which deletes all but the last of a sequence of ↑'s. Thus no additional rules are needed to account for pre-clause lowering in a dynamic-tone analysis of Igbo.[17] Since the rule of Phrase-final-↓ Deletion is optional, as we saw in section (3.2) above, the analysis given here leads us to expect that pre-clause lowering should also be optional, and that is in fact the case.

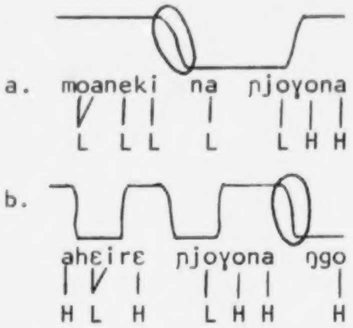
3.7 Conclusion. The tonal system of Igbo provides the following sorts of evidence for a dynamic theory of tone: First, the dynamic-tone theory allows a simple and direct statement of the fact that the boundary between the two constituents of a possessive phrase in Igbo is marked with a drop in pitch. Secondly, the effect of the associative pitch drop on the tone contours of surrounding elements can be interpreted very naturally within a dynamic-tone theory as the deletion of tone markers which lie within a prescribed distance to either side of the associative ↓. This is in contrast to level-tone theories, where the associative morpheme is analyzed as a "floating" level tone segment, and where the effect of that morpheme on the surrounding tone contour appears arbitrary and mysterious. Thirdly, in a dynamic-tone analysis of Igbo, the tonal differences between common and proper noun possessives arise naturally from a difference in the syntactic position of the associative ↓ in the two constructions. I have not been able to find any satisfactory way to mirror this analysis within a level-tone theory. Finally, the phenomenon which I have called "pre-clause lowering" is predicted by independently-motivated rules within the dynamic-tone analysis. Its ability to predict this tone-change is an important advantage of the dynamic-tone theory, because rule (3.6-2), which accounts for this phenomenon within a level-tone theory, is an unnatural rule which, moreover, refers to the syntactic structure of the string in a very unconstrained way. (See the discussion of the interaction between phonology and syntax in Chapter VIII.)

4. Kikuyu

4.1 Introduction. In section 3 above, I argued that the boundary between the two constitutents of a nominal phrase in Igbo is marked with a drop in pitch, which may be symbolized by the tone marker ↓. This tone marker interacts with the surrounding tone contour by causing the deletion or retraction of pitch changes which would otherwise take place near it, on either side. In this section, I will discuss some data from Kikuyu, another tone language which uses a drop in pitch as a marker of syntactic structure.[18] Kikuyu is of interest to us for three reasons: First, it provides strong evidence for the existence of a phonological unit which represents a drop in pitch. Secondly, although the syntactically-introduced pitch drop of Kikuyu interacts with the surrounding tone contour in quite different ways from that of Igbo, the nature of the interaction is again such as to strongly suggest that the entire tone contour must be expressed in terms of dynamic tones. Thirdly, there is an "intonational" tone change at the end of a phrase in Kikuyu which provides further evidence for a dynamic representation of tone.

4.2 The "Downstep" in Kikuyu. There are two syntactic environments in Kikuyu which are marked with a drop in pitch. First, there is a lexical class of words, called "Class I words", which have a drop in pitch after them. For example, in the phrases below, there is a (circled) pitch drop after the Class I words *moaneki* (a) and *njoɣona* (b), even though there is no change in lexical tone level at that point in either phrase:

(4.2-1)



a. 'Mwanĩki and Njũgũna'

b. 'He gave Njũgũna firewood.'

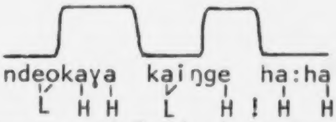
Note that the drop in pitch (or "downstep") which marks this syntactic environment is the same size as a drop from high to low.[19] In the analysis proposed by Clements and Ford (1977), the downstep at the end of a Class I word is simply included in its lexical representation. Thus the Class I word *kanεri* (personal name) is represented as

(4.2-2) Kanεri
| | | !
L L H

I follow Clements and Ford here in representing the downstep with a raised exclamation point "!", while the lexical tone of the word itself is represented as a sequence of level tones. I believe this notation was first proposed by Winston (1960).

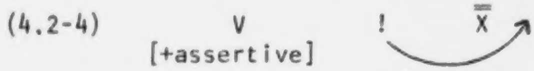
There is one other syntactic boundary in Kikuyu which is marked with a downstep. In particular, there is a downstep after the $\bar{\bar{X}}$-phrase which follows an assertive verb.[20] For example, the word *kaiŋge* 'often' is a Class II word which is ordinarily not followed by a downstep. Nevertheless, there is a downstep after *kaiŋge* in the phrase below, where it follows the assertive verb *ndeokaɣa*:

(4.2-3)



'I will be coming often here.'

Following Clements and Ford, I assume that the downstep which appears in this environment originates after the verb, and that it is moved to the right of the following $\bar{\bar{X}}$-phrase by a rule of the form



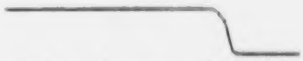
(4.2-4) $\underset{[+\text{assertive}]}{V}$! $\bar{\bar{X}}$

4.3 Why the downstep must be represented by a phonological unit. In rule (4.2-4) and in the lexical representation of (4.2-2), the downstep is represented by the symbol "!", which is a unit of the phonological string. Now let us consider whether the drop in pitch which marks these syntactic environments might alternatively be accounted for by means of a rule like the following:

(4.3-1) Lower the pitch register of the voice at the end of a class I word and at the end of an $\bar{\bar{X}}$-phrase which follows an assertive verb.

Clements and Ford make a strong argument against an analysis of this sort by pointing out that there are certain "exceptional" environments -- for example, between a noun and its complement -- in which the expected drop in pitch does not occur. Thus there is no pitch drop after the Class I word *ŋɔmbɛ* 'cows' in the following phrase, where it is followed by a modifying adjective:

(4.3-2)



ŋɔmbɛ hɔ:rɛ:ri ndito 'fat, gentle cows'

L L L L L ! L L

Exceptions of this sort are difficult to account for in an analysis which introduces the downstep by means of a rule like (4.3-1), because the theory of generative phonology provides no mechanism for saying "Lower the pitch register of the voice after a Class I word UNLESS IT IS A NOUN WHICH IS FOLLOWED BY A COMPLEMENT." However, if the downstep is a unit of the phonological string, as we have assumed, then this exceptional environment is easily accounted for by means of a rule of the form

(4.3-3) $! \rightarrow \emptyset$ / N ___ Comp

A second even stronger argument is based on the rule of Kikuyu which Clements and Ford call "Flattening". This rule lowers a string of high-toned syllables following a low tone at the end of a Class II noun which comes at the end of a phrase. The rule is stated formally as follows:

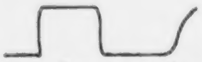
(4.3-4) Flattening.

$H_Q \rightarrow L_Q$ / L ___ $\#_S$

The symbol "H_Q" represents the maximal sequence of high-toned syllables, and "$\#_S$" represents the boundary at the end of a sentence. The rule applies, for example, to the word *moɣɛrania*
L L L H
'examiner', changing it to *moɣɛrania* in isolation at the end of
L L L L
a sentence.

Now notice that if the downstep at the end of a Class I word is a unit of the phonological string, then it is not necessary to specify that Flattening applies to Class II words only, for the "!" at the end of a Class I word like *kaŋɛri*, will prevent it from
L L H'
meeting the structural description of the rule. Furthermore, there is evidence that it is indeed the "!" which blocks the application of Flattening in such a case, for even a Class II word does not undergo Flattening if it lies at the end of an $\bar{\bar{X}}$-phrase which follows an assertive verb -- that is, if it has had a "!" inserted after it by rule (4.2-4). For example, the Class II noun *ɲɔ:mba* 'house' does not undergo Flattening in the phrase below,
L LH
where it follows the assertive verb *ɲɔ:nirɛ*:

(4.3-5)



ɲɔ:nirɛ ɲɔ:mba 'I saw house'

L H H L LH!

The fact that *ɲɔ:mba* does not undergo Flattening in this syntactic environment is automatic in an analysis which uses the phonological unit "!" to represent a downstep, for the downstep marker will block the application of Flattening when it has been introduced by rule (4.2-4) just as it does when it is part of the lexical representation of a Class I word.

The same cannot be said of an analysis in which the downstep is introduced by rules of the form of (4.3-1). In such an analysis, the rule of Flattening would have to be stated as follows:

(4.3-6) Lower the string of high-toned syllables at the end of a Class II word if (i) that string is preceded by a low tone, (ii) the word comes at the end of a phrase, and (iii) THE WORD DOES NOT COME AT THE END OF AN $\bar{\bar{X}}$-PHRASE WHICH FOLLOWS AN ASSERTIVE VERB.

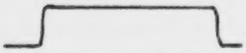
This analysis is unsatisfactory both because it introduces an exception environment into the structural description of a rule, and because it fails to provide a principled basis for the occurrence of the syntactic environment "at the end of an X-phrase which follows an assertive verb" at two different points in the grammar (in this rule and in rule (4.2-4) above). In an analysis of this sort there is no reason why this particular syntactic environment rather than some other arbitrarily-chosen one should serve as an exception environment for the rule of Flattening.

Having seen the evidence that the downstep site in Kikuyu must be marked with a phonological unit, let us now consider whether that unit must in fact represent a drop in pitch (as does Clements' and Ford's "!"), or whether it might be a floating level tone like the floating high tone which some linguists have hypothesized at the boundary between a possessive NP and the noun which it modifies in Igbo. (In that case the drop in the pitch level of the voice would be accomplished by a rule which applies in the environment of a floating tone.)

Surely the answer is that the unit which marks the downstep site must represent a drop in pitch, for if it were a floating level tone, then that tone should manifest itself in some way besides just inducing a drop in the pitch level of the voice. However, the drop in pitch level is the only phonetic reflex of the unit which marks this site. Moreover, it is not really plausible to suggest that this drop in pitch could be triggered by a floating level tone, for there is no reason why a floating tone should have that effect. I conclude that the phonological unit which occupies the downstep site in Kikuyu must represent a drop in pitch. Thus even a level-tone theory must make use of pitch-drop markers like Clements' and Ford's "!".

4.4 Why the entire tone contour of Kikuyu should be represented in dynamic-tone terms. There are two tonal processes in Kikuyu which strongly suggest that the entire tone contour (and not just the downstep itself) should be represented in terms of pitch drop markers and pitch rise markers. The first of these is a process which Clements and Ford call "downstep displacement", by which the downstep marker interacts with the surrounding tone contour. The second is an "intonational" tone change which takes place at the end of a phrase. I will take up these processes in the order in which they are listed here.

The process of "downstep displacement", whereby the syntactically-introduced downstep marker interacts with the surrounding tone contour, is illustrated by the derivation below:



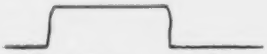
(4.4-1) ndinarɔra keŋaŋi ⇒ ndinarɔra keŋaŋi

L H H H ! L L H L H H H H H!H

'I didn't watch' 'crocodile' 'I didn't watch the crocodile.'

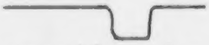
Here the downstep at the end of the Class I word *ndinarɔra* (L H H H!) 'I didn't watch' has moved over the sequence of low tones to its right, converting that string to a sequence of high tones. The examples below show that the "!" is not displaced when it is (a) followed by a high tone, or (b) preceded by a low tone:

(4.4-2) a.



ndinarɔra ɲjata 'I didn't watch stars.'
L H H H ! H H !

b.



moaneki ɔnirɛ 'Mwaniki saw.'
L L L !L H H

Clements and Ford thus state the rule of Downstep Displacement in the following way:

(4.4-3) Downstep Displacement

$$H\ !\ L_Q \Rightarrow H\ H_Q\ !$$

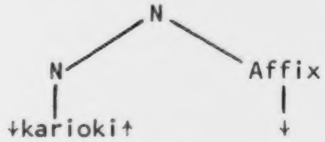
This rule moves the downstep marker "!" over the maximal sequence of low tones to its right, converting that sequence to high. The rule applies just in case the "!" is preceded in the underlying form by a high tone.

While the rule of (4.4-3) produces the correct output in every case, certain features of the rule are quite arbitrary. For example, there is no principled reason why this process should apply only when the "!" is preceded by a high tone. Nor is it clear why the movement of a downstep marker to the right of a string of low-toned syllables should cause that string to become high-toned.

The apparent arbitrariness of these properties of the process of downstep displacement disappears when the entire tone contour is viewed in dynamic terms. To show that this is so, I will first motivate a particular representation of Kikuyu lexical tone and of the downstep marker itself and will then show that the distribution of downstep displacement and the changes which it creates follow naturally when the underlying tone contour is represented dynamically.

Noting that there are rising glides at the end of words such as *karioki* (personal name) in Kikuyu, and assuming that such a
L L LH!
glide must be represented by a ↑ after the final syllable of the word, I conclude that the tone marker which indicates the tone level of a word of Kikuyu with respect to other words of the phrase must come at the beginning of the word, as in Mende, and not at the end as in Igbo. Thus the word *karioki* will be represented in
L L LH!
dynamic terms as

(4.4-4)



I assume here that the "downstep" at the end of a Class I word like *karioki* is an independent lexical unit consisting of a ↓ only, like the associative ↓ of Igbo. The reasons for this assumption are (i) that the distribution of this element is affected by syntactic rules such as (4.2-4) and (4.3-3), and (ii) that one does not in general find two tone markers dominated by the same lexical node without a tone-bearing unit between them, as would be the case if the "downstep" of (4.4-4) were not a separate lexical entity.. I have followed Clements and Ford here in assuming that the downstep is present in the lexical representation of a Class I word. However, it might alternatively be introduced by a surface-level rule.

Given the above assumptions about the representation of lexical tone in Kikuyu, a Class II word like *moɣɛrania* 'examiner', which has
L L L H
no gliding tone on its final syllable, and no associated downstep, must be represented as follows:

(4.4-5) ↓moɣɛra↑nia

The rule of Flattening which applies to words of this class can then be stated quite simply as follows:

(4.4-6) Flattening.

↑ ... $

s.d. 1 2 3, where 2 contains no tone markers.

s.c. 1 > Ø

This rule deletes a ↑ which is the final tone marker of a phrase. By this rule the word ↓*moɣɛra*↑*nia* (4.4-5) becomes ↓*moɣɛrania* in isolation or at the end of a phrase. Flattening does not apply to Class I words like *kariokі*↑#↓ (4.4-4) because the downstep ↓ at the end of such a word prevents it from meeting the structural description of the rule. Note that this account of the Flattening process depends crucially on the assumption that the tone level of a word of Kikuyu is indicated by means of a tone marker at the beginning of the word, so that *moɣɛrania* has the representation shown in (4.4-5). This analysis of the Flattening process thus tends to confirm the assumption which we made above about the representation of lexical tone in Kikuyu.

Returning now to the phrase of (4.4-1), which undergoes "downstep displacement", we may represent the underlying form of this phrase in dynamic terms in the following way:

(4.4-7) ##↓ndi↑narɔra ##↓#↓keŋa↑ŋi ##

'I didn't watch the crocodile.'

In setting up this underlying representation, I have assumed that the downstep ↓ of Kikuyu, like the associative ↓ of Igbo, cliticizes to the constituent to its right, forming a single phonological word with it.

Assuming the underlying representation of (4.4-7), the rule of ↓-Displacement (replacing Downstep Displacement) is easily stated as follows:

(4.4-8) ↓-Displacement

↓ ↓ ... ↑

s.d. 1 2 3 4 5

s.c. Replace 5 with 3.

Condition: 4 contains no tone markers.

This rule moves the second of a sequence of ↓'s at the beginning of a word into the position of the first ↑ of that word. Note that the structural description of the rule will be met only by an initially low-toned word with a downstep marker before it. The rule applies, for example, to the underlying string (4.4-7), moving the ↓ at the beginning of ↓*keŋa*↑*ŋi* 'crocodile' into the position of its internal ↑, and creating the intermediate form

(4.4-9) ##↓ndi↑narɔra ## $\underline{\downarrow}$ # keŋa↓ŋi ##

The deletion of the (underlined) downstep ↓ is then accomplished by means of the rule

(4.4-10) ↓-Deletion.

↓ ... ↓

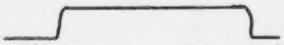
s.d. 1 2 3 4

s.c. Delete 2.

Condition: 3 contains no tone markers.

This rule applies to the intermediate form (4.4-9) to create the output tone contour

(4.4-11)

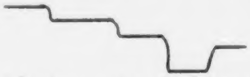


ndi ↑narɔra keŋa↓ŋi

'I didn't watch the crocodile'

It may appear to be a disadvantage of this analysis (as compared with the analysis proposed by Clements and Ford) that it requires two rules to derive this surface tone contour. In fact it is not a disadvantage, since Clements and Ford observe that there are speakers who leave a pitch drop in both places (that is, who stop with the "intermediate" form) when the word following the downstep site is a Class I word. An example is the phrase

(4.4-12)

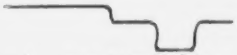


↑ti ↓moa ↓ɣa↓hi↑ɲa↓ 'It isn't a weakling!'

(from ↑ti *##* ↓ *#*↓moa↑ɣa↓hi↑ɲa↓*#*)

In the more generally-spoken dialect, this phrase would be pronounced

(4.4-13)



↑ti moa↓ɣa↓hi↑ɲa 'It isn't a weakling'

with the downstep at the beginning of *moaɣahiɲa* having been deleted from the surface form. This dialectal variation is not easily accounted for within the analysis proposed by Clements and Ford, using the Downstep Displacement rule of (4.4-3). However, it is easy to account for in the present analysis, simply by restricting the rule of ↓-Deletion for speakers who use the contour (4.4-12) to Class II words only. These speakers will not apply ↓-Deletion to the Class I noun *moaɣahiɲa* 'weakling' in (4.4-12), and the output tone contour for this phrase will be as shown. Speakers who use the tone contour of (4.4-13) apply ↓-Deletion to both Class I and Class II words.

Now observe that those features of the rule of Downstep Displacement which seemed arbitrary when the rule was expressed in terms of tone levels have a principled basis in our dynamic-tone analysis. For example, consider the fact that the downstep is displaced only when it is followed by a word which begins on a low tone level. In the dynamic-tone analysis, this property of the rule follows from the fact that this is the only case in which we obtain the double "↓" which the rule acts to break up. (There are other rules in Kikuyu which break up other double-tone-marker sequences. For example, the rule of Like-Tone-Marker Deletion ((4.4-14) below), breaks up a double ↑, and there is evidence for two rules which act to break up a ↓↑ sequence.)

Secondly, consider the effect of the downstep on the string of low tones over which it passes. In Clements' and Ford's level-tone analysis, the mere movement of the downstep to its surface position is not sufficient to account for the surface tone of this string, because the sequence L!H is ordinarily pronounced on a single pitch level, with no change of pitch between the "L" and the "H". (See fn. 19.) Thus in order to account for the DROP in pitch at the downstep site in (4.1-1), Clements and Ford must specifically state that the string of low tones over which the downstep passes becomes a string of high tones. No such statement is needed in the dynamic-tone version of Downstep Displacement (4.4-8) for the string of low tones which follows the downstep in the underlying form is raised automatically when the ↑ which follows it is replaced by a ↓.

Finally, consider the fact that Downstep Displacement does not apply in phrases like (4.4-2 b), in which the downstep site is preceded by a low tone. This fact, which must be included quite arbitrarily in the level-tone version of this rule (4.4-3), has a more principled basis within our dynamic-tone analysis, which is as follows: Kikuyu, like other languages which use a word-initial tone marker to indicate word tone level, must have a rule of Like-Tone-Marker Deletion which deletes the second of a sequence of two like tone markers. Let us assume that in Kikuyu, as in Igbo, this rule deletes a ↓ only if it is at the boundary of a phonological word; in other words, let us assume that the rule of Like-Tone-Marker Deletion for Kikuyu is stated as follows:

(4.4-14)
$$\begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} \quad \ldots \quad <\#\#> \begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} \quad \ldots \quad \$$$

s.d. 1 2 3 4 5 6

s.c. Delete 4.

Condition: 2 contains no tone markers.

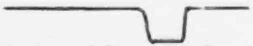
This rule deletes a ↓ in the environment "↓... ##___" and a ↑ in the environment "↑... __.".[21]

Now consider the phrase *moaneki ɔnirɛ* 'Mwaniki saw.' (4.4-2 b). The underlying dynamic-tone representation for this phrase is as follows:

(4.4-15) ↓moaneki *##* $\underline{\downarrow}$ *#* ↓ɔ↑nirɛ*#*↓

If we order the rule of Like-Tone-Marker Deletion before the rule of ↓-Displacement (4.4-8), then the underlined ↓ of (4.4-15) will have been deleted before it can trigger ↓-Displacement. The resulting output tone contour is

(4.4-16)

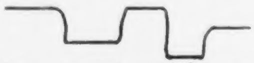


↓moaneki ↓ɔ↑nirɛ

which is correct.

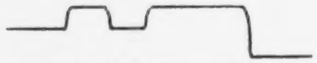
The last tonal process of Kikuyu which I will discuss here is a process which I will call "End-of-phrase Lowering", whereby the last pitch drop of the phrase is made larger than it would be ordinarily. Some examples are given below:

(4.4-17) a.



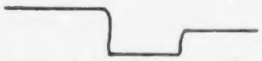
↑ne ↓moa↑ɣa$\underline{\downarrow}$hi↑ɲa 'weakling' (assertion)

b.



↓moa↑ɣa↓hi↑ɲa mo$\underline{\downarrow}$rito 'heavy weakling'

c.



↑ne ke$\underline{\downarrow}$ɣire↑reria 'hindrance' (assertion)

The pitch drop which is enlarged in each phrase in these examples is underlined.

The rule of End-of-phrase Lowering can be stated as follows in a dynamic-tone framework:

(4.4-18) End-of-phrase Lowering.[22]

$\downarrow \; \ldots \; \$$

s.d. 1 2 3, where 2 contains no ↓.

s.c. 1 > large

According to Clements and Ford, the degree to which the final pitch drop of the phrase is enlarged by this rule varies with the emotional state of the speaker.

The facts described above can also be stated in a level-tone framework, by means of a rule like the one below, from Clements and Ford:

(4.4-19) $\emptyset \rightarrow \, ! \; / \; \_\_\_ \; L_Q \; (H_Q) \; \#_S$

However, this statement of the rule is considerably less satisfactory than the dynamic-tone version given above, because it gives us no explanation of why the drop in pitch should occur at just this particular point in the string. The downstep which is inserted by this rule could just as easily have been placed at some other point; in fact, a simpler statement of the rule could be given if it were found before the final tone segment of the phrase instead of before the final string of low tones.

4.5 Summary. In summary, I have argued here (following Clements and Ford), that the syntactically-introduced downstep of Kikuyu should be represented by a phonological unit which signifies a drop in pitch. Going beyond Clements' and Ford's proposal I have argued, in addition, that the entire tone contour of a Kikuyu phrase should be represented in dynamic terms. In particular, I have argued that the tone change which is created by the rule of ↓-Displacement and the fact that the rule applies only after a high tone and before a low tone have a more principled basis in a dynamic-tone framework than in a level-tone one. The rule of End-of-phrase Lowering, which makes the last pitch drop of a phrase extra large, is another rule which is expressed more naturally in dynamic-tone terms.

Because the analysis given here is based on a small corpus, and, in fact, accounts for only part of the data which is discussed by Clements and Ford, the statements which I have given of particular tone rules must be regarded as tentative. Nevertheless, I believe that this analysis is sufficiently well worked out to suggest the kind of insights one may obtain into the tonal system of Kikuyu by viewing that system in dynamic terms.

5. Mandarin

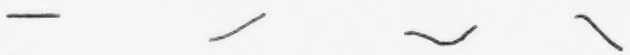
In the preceding sections of this chapter, I have argued for a dynamic representation of tone in three tone languages: Osaka Japanese, Igbo, and Kikuyu. The first of these, Osaka Japanese, is a "borderline" tone language with lexical tone contours only slightly more unpredictable than those of a pitch-accent language. The existence of such languages fulfills the prediction of the dynamic-tone theory that there should be no sharp division between pitch-accent and tone languages.

In Igbo and Kikuyu, I have focused particularly on the use of a drop in pitch, or "downstep" to mark certain syntactic boundaries. The insertion of a pitch drop into the string and the interaction of that pitch drop with the surrounding tone contour have been found to be expressible in a particularly satisfactory way within a dynamic-tone theory. In addition, both of these languages exhibit "intonational" tone changes at the end of a phrase which lend themselves nicely to analysis in dynamic-tone terms.

I will now consider two Chinese languages, Mandarin and Chaochow, which make use of a greater number of lexical tone contrasts than do the languages which we have been concerned with up to now. Although at first glance these languages would seem to present serious difficulties for a dynamic-tone theory, I will show here that this theory is not only capable of expressing the tonal systems of these languages, but provides an elegant account of certain tonal alternations which are difficult to account for in a level-tone framework.

Mandarin makes use of four lexically-distinct tones:

(5-1) (a) HIGH (b) RISING (c) LOW (d) FALLING[23]



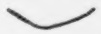
b a b a b a b a

'eight' 'to uproot' 'to hold' 'a harrow'

The four "citation" tones given here are found only on stressed syllables; unstressed syllables have special tonal properties which will be discussed below.

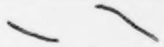
Notice that the third tone above, the "low" tone, has a falling-rising contour in its citation form, and that it is about half again as long in duration as the other tones.[24] This is the form the tone takes in isolation, or when it comes at the end of a phonological phrase. Inside a phrase, a syllable which carries this tone has normal syllable length, and its tone contour changes in ways which are predictable from the tone of the following syllable. In particular, the low tone is realized as a level low tone when it is followed by a high, rising, or falling tone, and as a rising tone when it is followed by another low tone. Examples are given below with the low-toned morpheme *lao*:

(5-2) a. Citation form.[25]



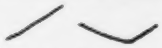
l a o

b. Before a falling tone.



l a o d a a

c. Before a low tone.



l a o z a o

I propose to account for these variations in the realization of the low tone in the following way: Accepting Woo's (1969) argument that there are no mono-moraic syllables in Mandarin, I will assume that the basic tone-bearing unit in Mandarin is the mora, and will represent the four citation tones of Mandarin as shown below:

(5-3) a. HIGH = $\mu\ \mu\downarrow$

b. RISING = $\mu\uparrow\ \mu\downarrow$

c. LOW = $\downarrow\mu\ \mu\uparrow\mu$

d. FALLING = $\mu\downarrow\ \mu\uparrow$

In the representations above, the relative tone level of each syllable with respect to adjacent syllables is indicated by a tone marker at the end of the syllable, and any change in pitch within the syllable is represented by an internal tone marker. The slightly falling pitch at the beginning of a low-toned syllable is the realization of a ↓ at the beginning of the syllable; the realization of this ↓ suggests a general tendency to continue a pitch change into the following mora.

The reduced length of the low tone when it is followed by another syllable within the same phrase may be accounted for by means of the following rule:

(5-4) Low Tone Shortening

[μ μ μ] ... $

s.d. 1 2 3 4 5

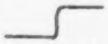
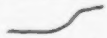
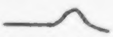
s.c. Delete 3.

Condition: 4 ≠ 0.

This rule deletes the third mora of a low-toned syllable when that syllable is non-final in its phrase. As a result of the application of this rule, a low-toned syllable takes the form ↓μμ↑ when it occurs internally in a phrase.

Having accounted for the reduced length of the low tone when it is non-final in its phrase, let us now account for the way in which the realization of this tone is affected by the nature of the tone which follows it. First, consider the case in which the low tone is followed by a high, rising, or falling tone. In this environment the low tone is realized as a low level tone, shorter in duration than its citation form, still with slightly falling tone early in the syllable. The underlying representations of these tone sequences after the application of Low Tone Shortening are shown below, along with what I take to be the appropriate representation of the surface contour of each tone sequence:

(5-5)

	Underlying Representation after Low Tone Shortening	Surface Tone Contour
a.	↓μμ↑ + μμ↓ low high	 ↓μμ↑μμ↓
b.	↓μμ↑ + μ↑μ↓ low rising	 ↓μμμ↑μ↓
c.	↓μμ↑ + μ↓μ↑ low falling	 ↓μμ↑μ↓μ↑

Except for that of (b), the contours of (5-5) are obtained by simply adding together the representations of the syllables which make up the phrase. (5-5 b) requires the addition of a rule of Like-Tone-Marker Deletion, which can be stated as follows:

(5-6) Like-Tone-Marker Deletion

$$\begin{bmatrix} +\text{tone} \\ <+\text{fall}> \end{bmatrix} \;\ldots\; \begin{bmatrix} +\text{tone} \\ <+\text{fall}> \end{bmatrix} \;\ldots\; \$$$

s.d. 1 2 3 4 5

s.c. Delete 1.

Condition: 2 contains no tone markers.

Now let us account for the realization of the low tone as a rising tone when it is followed by another low tone, as in (5-2 c). The first of the low-toned syllables in this example is, of course, subject to Low Tone Shortening, so that this phrase has the underlying representation shown below:

(5-7) ↓μμ↑##↓μμ↑μ
low low

However, the surface realization of this sequence is like that of the sequence "rising, low", shown below:

(5-8) μ↑μ##↓μμ↑μ

rising low

This fact is easily accounted for by means of a rule of ↑-Retraction, which may be stated as follows:

(5-9) ↑-Retraction

μ μ ↑ ↓ ... $

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

This rule moves a ↑ one mora to the left when it is immediately followed by a ↓. This rule is virtually identical to the ↑-Retraction rules which were motivated earlier for Igbo and Mende, and there is also evidence for such a rule in Kikuyu, though I have not been given it here. Thus the change of a low tone to a rising tone in the environment before another low tone is not at all surprising when viewed in dynamic-tone terms, for the rule which effects this change is one of the most common of all tone rules. The fact that it allows such a reasonable account of the merger of the low and rising tones in the environment before a low tone is one of the major arguments for a dynamic-tone analysis of Mandarin.

The rules which have been introduced here to account for the behavior of the low tone also account for the surface contours of all other sequences of tones, with one exception -- an additional rule is needed to account for the realization of a "falling, low" sequence, which, I assume, has the surface contour shown below:

(5-10) μ↓μ↑ + ↓μμ↑μ ⇒ μ↓μ μμ↑μ

falling low

The deletion of the ↑↓ which appears in the underlying string above can be accounted for by means of the streamlining rule below:[26]

(5-11) Streamlining

[+tone][+tone] ... $

s.d. 1 2 3 4

s.c. Delete 1 and 2.

If this rule is ordered after Like Tone Marker Deletion, it is unnecessary to specify that the tone markers which are deleted by this rule are not identical to one another.

The four rules which have been introduced so far are repeated below, in the order in which they must apply:

(5-12) a. Low Tone Shortening

[μ μ μ] ... $

s.d. 1 2 3 4 5

s.c. Delete 3.

Condition: 4 ≠ 0

(5-12) b. Like-Tone-Marker Deletion

$$\begin{bmatrix} \text{+tone} \\ \text{<+fall>} \end{bmatrix} \ \ldots \ \begin{bmatrix} \text{+tone} \\ \text{<+fall>} \end{bmatrix} \ \ldots \ \$$$

s.d. 1 2 3 4 5

s.c. Delete 1.

Condition: 2 contains no tone markers.

c. ↑-Retraction

$\mu \ \mu \ \uparrow \ \downarrow \ \ldots \ \$$

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

d. Streamlining

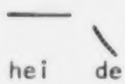
[+tone][+tone] ... $

s.d. 1 2 3 4

s.c. Delete 1 and 2.

It was pointed out at the beginning of this section that the citation tones of Mandarin occur on stressed syllables only. An unstressed syllable has no tone of its own; instead, its tone is determined by the tone of the preceding syllable, as can be seen from the examples below, where the tone of the unstressed ("neutral") syllable *de* varies with the tone of the stressed syllable which precedes it:[26]

(5-13) a.

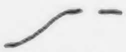


hei de

HIGH NEUTRAL

'black'

b.

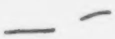


hong de

RISING NEUTRAL

'red'

c.

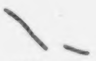


zii de

LOW NEUTRAL

'purple'

d.



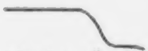
lüü de

FALLING NEUTRAL

'green'

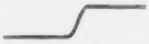
The unstressed syllable *de* in the examples above has falling tone after high, high tone after rising, rising tone after low, and low tone after falling. If we assume that unstressed syllables are, in fact, toneless, then the tone contours of (a) and (c) are exactly what is predicted by the tone representations which were proposed for the high and low tones in (5-3) above. Thus the tone representation which we obtain for (5-13 a) and (5-13 b) are as follows:

(5-14) a.



↑hei↓ # de
'black'

b.

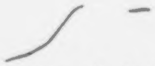


↓zii↑ # de
'purple'

Notice that the final tone change of the stressed syllable in these examples is "delayed" slightly in relation to the phonological string, so that the ↑ of (b), and even more noticeably the ↓ of (a), are realized partly as gliding tones on the unstressed syllable *de*. This tendency to extend a tone change (especially a ↓) into the following mora was pointed out earlier, as an explanation for the slightly falling pitch at the beginning of a low-toned syllable ($\downarrow\mu\mu\uparrow(\mu)$).

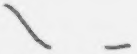
The rightward shift of a tone change which comes before an unstressed syllable is accentuated when the final mora of the stressed syllable is itself preceded by a tone marker, as will be the case when the stressed syllable has rising or falling tone (as in (5-13 b) and (5-13 d)). Here the final tone marker of the stressed syllable is moved all the way to the end of the unstressed syllable, so that there is no change of pitch between the stressed and unstressed syllables. In other words, the underlying forms shown on the left below are converted into the surface forms shown on the right:

(5-15) a.



ho↑ng$\underline{\downarrow}$ # de ⟹ ho↑ng # de$\underline{\downarrow}$ 'red'

b.



lü↓ü$\underline{\uparrow}$ # de ⟹ lü↓ü # de$\underline{\uparrow}$ 'green'

The rightward shift of the tone marker at the end of the stressed syllable in the examples above may be expressed formally by means of the following rule:

(5-16) [+tone] μ [-stress] [+tone] μ [-stress] ... ##
s.d. 1 2 3 4 5 6

s.c. Move 3 to the right of 4.

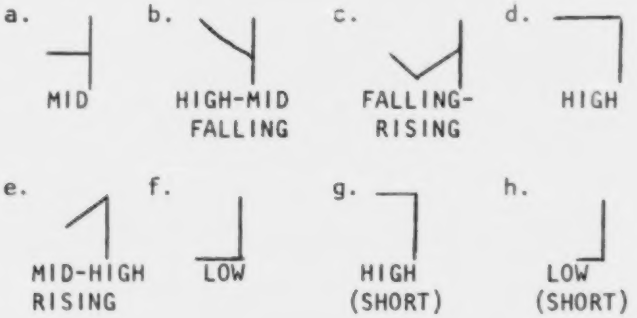
This rule applies to the underlying forms on the left in (5-15), converting them into the surface forms on the right. In moving a tone marker away from the boundary between two unstressed moras, this rule is performing a tone change of a very natural sort, for it is unusual in any language to find a tone change between two unstressed tone-bearing units.

Its ability to provide a simple and natural account of the tone contours of stressed-unstressed syllable combinations in Mandarin is a strong advantage of the dynamic-tone theory, for it seems doubtful that a satisfactory account of these tone contours can be obtained within a level-tone theory. In addition, as we saw above, the dynamic-tone theory allows a particularly satisfactory account of the change of a low tone to rising in the environment before another low tone. It is these two sets of facts which create the strongest motivation for a dynamic-tone analysis of Mandarin.

6. Chaochow[28]

The tonal system of Chaochow is extremely complex, with the eight "isolation" tones shown below:

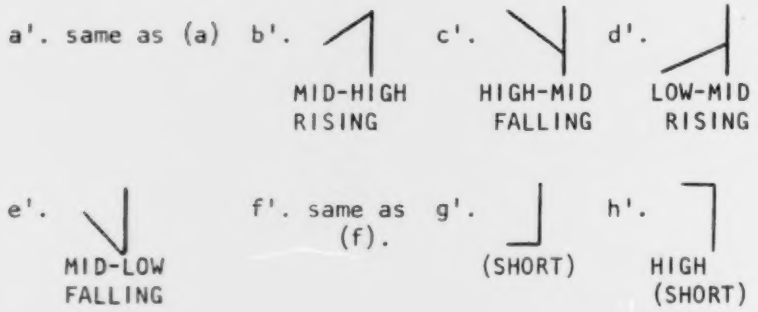
(6-1)



All syllables of Chaochow are long except those with the structure $[C_0V[-son]]$, which have short vowels, and which bear tones (g) and (h) only. A syllable which bears the falling-rising tone (c) is extra-long; I follow Woo in assuming that this is a three-mora syllable. All other syllables are two moras in length, with the structure $[C_0\ V\ N]$ or $[C_0V\ V]$.

A syllable takes one of the isolation forms shown above when it occurs either at the end of a phrase or before an unstressed syllable. Before a stressed syllable, a tone assumes its "combination" form, which may differ rather radically from its isolation form, as shown below:

(6-2)



I propose to represent the tones of (6-1) and (6-2) in dynamic-tone terms in the following way:

(6-3) Isolation Tones.

a. μμ b. ↑μ↓μ c. ↓μμ↑μ d. ↑μμ

e. ↓μ↑μ f. ↓μμ g. ↑μ h. ↓μ

(6-4) Combination Tones.

a'. μμ b'. μ↑μ↓ c'. ↑μ↓μ d'. ↓μ↑μ

e'. μ↓μ↑ f'. ↓μμ g'. ↓μ↑ h'. ↑μ↓

In the representations above, the tone level on which the syllable begins is indicated by a tone marker at the beginning of the syllable. To be specific, a syllable which begins on a low tone level has an initial ↓, and one which begins on a high tone level has an initial ↑. The "mid" tone ((a), (a')) is analyzed here as a toneless syllable.[29] Changes of pitch within the syllable are represented by internal tone markers. In addition, there are tone markers at the ends of the combination forms (b'),(e'),(g'), and (h') which help to determine the pitch relationship of syllables bearing these tones to a following syllable.[30] Since the isolation forms occur only at the end of a phrase or before an unstressed syllable, I assume that it is unnecessary to indicate their pitch relationship to the following syllable. Hence none of the isolation tones of (6-3) has a syllable-final tone marker.

Given the representations of (6-3) and (6-4), we can derive the contours of all possible sequences of tones by means of a kind of amalgamation of adjacent tone markers, whereby a sequence ↑↑ or ↓↓ is realized as an extra-large rise or fall in pitch, and a sequence of ↓↑ or ↑↓ is simply deleted. The rule for this deletion can be stated as follows:

(6-5) Streamlining

[+tone] [+tone] ... $

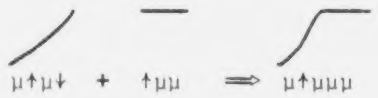
s.d. 1 2 3 4

s.c. Delete 1 and 2.

Condition: 1 ≠ 2.

Rule (6-5) applies, for example, in the derivation of the tone contours below:

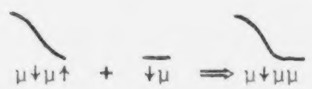
(6-6) a.



μ↑μ↓ + ↑μμ ⟹ μ↑μμμ

(b') (d)

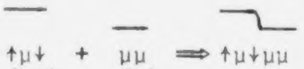
b.



μ↓μ↑ + ↓μ ⟹ μ↓μμ

The fact that there is no rule of Like-Tone-Marker Deletion, and the provision for the realization of two contiguous identical tone markers as a single, extra-large change of pitch allows us to account for the difference in the size of the pitch change in tone-pairs like the following:

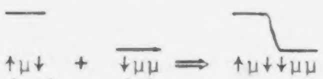
(6-7) a.



↑μ↓ + μμ ⟹ ↑μ↓μμ

(h') (a)

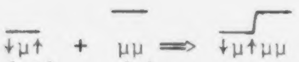
b.



↑μ↓ + ↓μμ ⟹ ↑μ↓↓μμ

(h') (f)

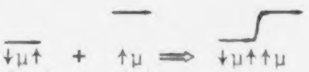
(6-8) a.



↓μ↑ + μμ ⟹ ↓μ↑μμ

(g') (a)

b.



↓μ↑ + ↑μ ⟹ ↓μ↑↑μ

(g') (g)

Rule (6-5), and the convention that contiguous identical tone markers are realized as a single extra-large pitch change, generate appropriate tone contours for all possible sequences of tones.[31]

Now consider how the isolation and combination forms of each tone are to be related to one another. At this point, we derive great benefit from having represented these tones in dynamic terms, for except for tone (c), which requires one additional rule, the isolation form of each tone can be derived from its combination form by means of the following simple rule, which shifts every tone marker within the syllable one mora to the left:

(6-9) Tone Marker Retraction

$[\ \ldots\ \ \mu\,[+\text{tone}]\ \ \ldots\ ]$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

Condition: This rule applies at the end of a phrase or before an unstressed syllable.

The derivations of all the isolation tones except (c) from their combination forms are shown below:

(6-10)

Combination form	Isolation form
(a') $\mu\mu$	no change (a)
(b') $\mu\uparrow\mu\downarrow$	$\uparrow\mu\downarrow\mu$ (b)
(d') $\downarrow\mu\uparrow\mu$	$\uparrow\mu\mu$ (d)
(e') $\mu\downarrow\mu\uparrow$	$\downarrow\mu\uparrow\mu$ (e)[32]
(f') $\downarrow\mu\mu$	$\downarrow\mu\mu$ (f)
(g') $\downarrow\mu\uparrow$	$\uparrow\mu$ (g)
(h') $\uparrow\mu\downarrow$	$\downarrow\mu$ (h)

Notice that in applying before an unstressed syllable, the rule of Tone Marker Retraction (6-9) performs the same function as the Mandarin rule (5-16) -- namely, it moves a tone marker away from the beginning of an unstressed syllable. However, it does so in a different manner, by moving the tone marker leftward instead of rightward. When the tone marker at the end of the syllable is shifted to the left, internal tone markers must be shifted also, so as to preserve the tone contour. The result is, as we have seen, a general leftward shift of every tone marker inside the syllable.

An additional rule is needed to relate the combination tone (c') = $[\uparrow\mu\downarrow\mu]_\sigma$ to its isolation form (c) = $[\downarrow\mu\mu\uparrow\mu]_\sigma$. If we assume the underlying representation $[\uparrow\mu\downarrow\mu\mu\uparrow]_\sigma$ for this tone, then its isolation form can be generated in the usual way, by means of the rule of Tone Marker Retraction (6-9). Its combination form can then be generated by means of a rule of Low Tone Shortening very much like the rule which was introduced in the previous section for Mandarin. This rule can be stated as follows:

(6-11) Low Tone Shortening

$$\mu \ \mu \ \uparrow \ ]_\sigma$$

s.d. 1 2 3

s.c. Delete 2 and 3.

If this rule is ordered after Tone Marker Retraction, then there is no need to add the condition that it applies only before a stressed syllable, for no tone except the underlying form of (c) and (c') meets its structural description.

In summary, I have argued here that within the dynamic-tone theory, independently-motivated representations of the isolation and combination forms of the Chaochow tones can be related to one another by a simple rule of Tone Marker Retraction. This rule converts a combination form into its isolation form by moving every tone marker back one mora when the syllable is phrase-final, or when it is followed by an unstressed syllable. One additional rule, the rule of Low Tone Shortening, is needed to generate the (c') tone. The rule of Streamlining plus a convention that two identical contiguous tone markers are realized as a single extra-large change of pitch accounts for the contours of all possible tone sequences.

The rules which have been introduced in this section are repeated below, in the order in which they must apply:

(6-12) a. Tone Marker Retraction

$[\ \ldots\ \mu[+\text{tone}]\ \ldots\ ]_{\sigma}$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

Condition: This rule applies at the end of a phrase or before an unstressed syllable.

b. Low Tone Shortening

$[\ \ldots\ \mu\ \mu\ \uparrow\ ]_{\sigma}$

s.d. 1 2 3 4

s.c. Delete 3 and 4.

c. Streamlining

$[+\text{tone}][+\text{tone}]\ \ldots\ \$$

s.d. 1 2 3 4

s.c. Delete 1 and 2.

Condition: $1 \neq 2$.

This analysis of Chaochow shows that a dynamic-tone theory can be applied with striking results to at least one language with three contrasting "tone levels" (high, mid, and low). This analysis suggests that such languages differ from languages with two contrasting tone levels primarily in the fact that they have no rule of Like-Tone-Marker Deletion.

FOOTNOTES TO CHAPTER II

[1] Where I have written μ (standing for "mora") in these lexical structure conditions and in the tone rules below, I should more properly have said "tone-bearing unit". In general, a mora and a tone-bearing unit are the same in Osaka, but there are some moras which are not tone-bearing units -- namely, those which consist of a non-sonorant consonant only. For example, the first [k] of

(i) sok\kusu 'socks'

is a mora, but not a tone-bearing unit. In Osaka, a non-sonorant mora and the mora which precedes it form a single tone-bearing unit, which may not have a tone-marker inside it.

[2] A similar treatment of the lexical tone contours of Osaka would be possible within the autosegmental theory were it not for the "accent-reduction" phenomenon which is discussed immediately below. The relevance of this phenomenon is as follows: If the difference between an "unaccented" word like *sakura* 'cherry tree' and an "accented" one like *i\noti* 'life' were simply a difference in how much of the HL tone contour is chosen for each word, then it would be difficult to understand why *i\noti* causes the deletion of the pitch drop of a particle, while *sakura* does not, as in the contrasting phrases shown below:

(ii) i\noti gurai 'only a life'

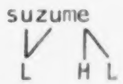
sakura gu\rai 'only a cherry tree'

It is the contrast in these phrases which motivates Haraguchi's classification of *i\noti* as an accented word, and *sakura* as an unaccented one. Having made this distinction between the two classes of nouns, he then quite rightly tries to derive the difference in their lexical tone contours from the difference in their accentedness.

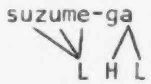
[3] Compare this dynamic-tone analysis with Haraguchi's autosegmental analysis of the same data, outlined below: First, the fact that the pitch rise shifts to the right when a particle is added to the end of a word, as in (2-14 b), is accounted for by means of the tone-association rule, which applies to a domain bounded by double word-boundaries. The tone association rule associates the H of the tone melody with the rightmost vowel which is not preceded by a V̈. In particular, it maps the tone melody LHL onto the words *suzume* 'sparrow' and *suzume-ga* 'sparrow'

+ nominative marker in the manner shown below:

(iii) a.



b.



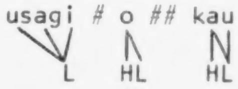
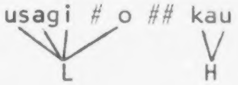
The tone-simplification rule (2-4) then simplifies the falling glide at the end of each word, creating the correct surface contour. Unfortunately, this account of the shift of the pitch rise to the right when a toneless particle is added to the end of the word cannot be extended to examples like *usagi-o∫kau* (2-14 c), which include two tonal domains. Thus Haraguchi introduces a special rule of "Collocational High Deletion", shown below, to account for the shifting of the pitch rise in phrases of this type:

(iv) Collocational High Deletion.

H → Ø / ## L ___ ## H

The rule of Collocational High Deletion lowers a high tone at the end of a word when it is preceded by a low tone and followed by a high tone. The application of the rule is illustrated in the following derivation of *usagi-o∫kau* 'keep a rabbit':

(v)

	Underlying representation after tone-mapping
Ø Ø	Tone Simplification
Ø	Collocational High Deletion
	Association of *o* with L (by the well-formedness condition which requires every syllable to be associated with a tone)

What is unsatisfactory about Haraguchi's analysis is that it treats the rightward shift of the pitch rise in

(vi) usa∫gi + o ⟹ usagi∫o 'rabbit' + object marker

as an entirely separate phenomenon from the rightward shift of the pitch rise in

(vii) $\underline{\text{usagi}}\int\overline{\text{o}}$ + $\overline{\text{kau}}$ $\Longrightarrow$ $\underline{\text{usagi-o}}\int\overline{\text{kau}}$ 'keep a rabbit'

In giving distinct analyses of these two cases, Haraguchi is claiming, in effect, that it is only accidental that the tonal processes which shift a pitch rise to the right both apply to the same class of words (those with the lexical tone contour of $\underline{\textit{usa}}\int\overline{\textit{gi}}$).

Whether or not a unified account of these phenomena COULD be given within an autosegmental theory depends on the exact form of the theory which one chooses.

[4] Unless otherwise indicated, the data in this section is taken from Green and Igwe (1963). A description of the phonological segments of Igbo is given in the appendix.

[5] There are no monosyllabic low-toned nouns, and only a very few monosyllabic high-toned ones. Igbo nouns typically begin with a vowel or syllabic nasal which is sometimes a clearly-identifiable prefix and sometimes not. There is vowel harmony within a morpheme, all vowels being taken either from the [+ATR] series ([i],[e],[u],[o]) or from the [-ATR] series ([ị],[a],[ụ],[ọ]).

[6] The Ọhụ̃hụ̃ dialect described by Green and Igwe does not use the H'H tone contour on bisyllabic nouns, but gives these words level high tone instead.

[7] This matter of directionality in defining tone level has also been observed by Voorhoeve (1971), who says, speaking of Bamileke:

> Not the level, but the change of level, seems to be basic to the system. The change of level can be indicated either in relation to the preceding or to the following level. In a sequence [¯-], the first tone can be indicated as higher than the following, or the last one as lower than the preceding tone.... The first interpretation seems to be used almost universally; a tone is interpreted as lower than, higher than, or on the same level as the preceding one.
>
> The second interpretation seems less universal and even somewhat strange. It is, however, theoretically equivalent...

Voorhoeve goes on to argue that Bamileke has a system of the second type, in which the level of each tone is defined in relation to the following tone. As we have seen here, Igbo also uses this system, in contrast to Mende which uses a system of the first type. My own observations agree with Voorhoeve's in suggesting that systems of the first type are more common than systems of the second type.

[8] The symbol "$$" stands for the end of a breath group. This rule applies even to a sequence of like tone markers which are separated from one another by a phrase boundary, as we will see below.

[9] A morpheme structure condition paralleling (3.1-20 a) is also needed in a level-tone analysis, to account for the fact that the first tone of a word is never 'H. Thus, the only "extra" ingredient in this dynamic-tone treatment of lexical tone in Igbo is the rule of Like-Tone-Marker Deletion. However, this rule is not really an extra, for it is independently motivated by facts to be described in section (3.5) below.

[10] The optional rule of Phrase-final-↓Deletion is not applied in this derivation.

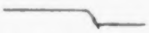
[11] The pronunciation of the associative ↓ as a gliding tone in this environment is probably a characteristic of the Ọhụhụ dialect in particular, since it has not been noticed by most linguists who have studied Igbo, including Ida Ward and William Welmers. These linguists also do not record the other instances of gliding tones which are noted by Green and Igwe, and which will be described in the following section.

[12] Note that this is a purely phonological process, for which the occurrence of tone markers in the string is irrelevant. I have therefore made no mention of tone markers in the structural description of the rule.

[13] The reason for stating the syntactic environment of this rule in terms of labelled bracketing rather than phonological boundaries is that certain verb forms have an initial pitch drop which does not metathesize with the following syllabic segment. To define the domain of the rule of ↓-Metathesis in terms of word-boundaries would incorrectly predict that the rule must also apply to these verbs. The tonal properties of verbal constructions in Igbo will be analyzed in Chapter VII.

[14] This restriction on the rule of ↓-Metathesis does not hold for ALL dialects of Igbo. Linda Waugh has sent me data from a dialect of Igbo in which this rule applies even when the initial vowel of the possessive noun phrase is low-toned. For example, in this dialect, the phrase of (3.4-6) would have the tone contour

(viii)



isi o↓ke↓ 'the head of a rat'

[15] Welmers (1968) states that this process applies to any possessive noun phrase which begins with a syllabic nasal,

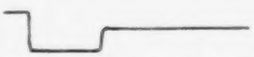
whatever the nature of the following consonant. However, Welmers' data is inconsistent on this point, and my own informant applies this rule only when the consonant which follows the syllabic nasal is also nasal.

Syllabic-nasal raising does not apply in the Ọhụh̃ụ dialect described by Green and Igwe, because that dialect has no words of the form [[+nas]↑[+nas]...]. Words which in other dialects are pronounced *m↑ma↓dhụ↑* 'man', *m↑mi↓r̃i↓* 'water', *m↑maỹa↓* 'wine', and so forth, are simply *ma↓dhụ↑*, *mi↓r̃i↓*, and *maỹa↓* in Ọhụh̃ụ.

[16] The loss of the internal ↓ of *mmụ↓ọ↓* in this example will be accounted for in Chapter VI, section 6.4.

[17] Notice that in order to obtain the correct output for (3.6-1 c) we have had to assume that that part of the rule of Like-Tone-Marker Deletion which deletes a ↑ before a ↑ applies after Phrase-Final-Deletion. However, it is not certain that the other subrule of Like-Tone-Marker Deletion, which deletes a word-final ↓ before a ↓, can also be ordered after Phrase-final-↓Deletion. For example, this rule ordering predicts that the application of Phrase-final-↓Deletion to the sentence

(ix)

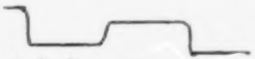


M↓ỹer̃e↑ Ekwe anụ↓ (from *m* + *ỹer̃e↑* + *Ekwe↓* + *anụ↓*)

'I gave Ekwe some meat' 'I' 'gave' 'meat'

should give rise to the alternative tone contour shown below:

(x)



M↓ỹer̃e↑ Ekwe↓ anụ

That is because the application of Phrase-final-↓Deletion to the underlying form of this sentence would leave the ↓ of *Ekwe↓* as the last tone marker of the phrase, and this ↓ would therefore not be deleted by Like-Tone-Marker Deletion. I do not know whether or not the tone contour of (x) represents a possible pronunciation of this sentence. If it does not, then the rule of Like-Tone-Marker Deletion must be split in two, with that part of the rule which deletes a ↓ before a ↓ applying before Phrase-final ↓ Deletion, and that part which deletes a ↑ before a ↑ applying after Phrase-final ↓ Deletion. On the other hand, if this IS a possible pronunciation of this sentence, then the rule ordering given in (3.4-23) is correct.

[18] The Kikuyu data given here, as well as the arguments in sections 4.2 and 4.3 below for the existence of a phonological unit which marks the downstep site, are taken from the preliminary version of a paper by G. N. Clements and Kevin C. Ford, entitled "On the Phonological Status of Downstep in Kikuyu." Most, but not all of the data discussed here is included in the final version of that paper, which appears in G. N. Clements, ed. (1977) *Harvard Studies in Phonology*, vol. I. I am grateful to Professor Clements for his kindness in allowing me access to the preliminary version of this paper.

[19] A downstep is never found at the surface level between high and low, for reasons which will be given below in section 4.4. A downstep may occur between a low and a high tone, and the resulting sequence "L $^{!}$ H" is realized as a level tone, with no change of pitch between the two tone segments.

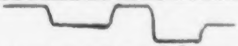
[20] "Assertive" verbs are those which appear in assertive clauses, where an assertive clause is either (i) an affirmative statement, (ii) a question which expects a positive reply, or (iii) a clause which makes use of the assertive topicalizer *ne*.

[21] The rule of Like-Tone Marker—Deletion is independently motivated by the fact that a verb with the tone configuration [... $^{!}H_Q$] never has a downstep after it, even in circumstances in which one would ordinarily expect to find a downstep there. Within the analysis proposed by Clements and Ford, it is necessary to add a very specific rule to account for this fact. No such rule is needed in the dynamic-tone analysis which is proposed here, because such a phrase must have the underlying representation

(xi) $\ldots \downarrow \ldots \#\#\underline{\downarrow}\# \ldots$

and the underlined downstep will be deleted by the rule of Like-Tone-Marker Deletion. The fact that no special rule is needed to account for the deletion of the downstep in this environment is another advantage of the dynamic-tone analyses.

[22] Note that *↓moa↑ɣa↓hi↑ɲa* 'weakling' and *↑ke↓ɣire↑reria* 'hindrance' in (4.4-17) must be followed by downsteps in the underlying representation, since neither of these nouns undergoes Flattening. Hence the ↓ which is magnified by rule (4.4-18) in these examples is not the last ↓ of the phrase in the underlying form. I therefore assume that there is a rule of Phrase-final Tone Marker Deletion in Kikuyu which applies before End-of-Phrase Lowering, but after Flattening. Thus the phrase of (4.4-17 a) has the derivation shown below:

$ ↑ne ## ↓moa↑ɣa↓hi↑ɲa # ↓ $	Underlying form
	Flattening, n.a.
∅	Phrase-final Tone Marker Deletion
↓	End-of phrase Lowering
 ↑ne↓moa↑ɣa↓hi↑ɲa	Output

[23] The tone contours shown here are taken from Kratochvíl (1968).

[24] The durations of the various tones have been measured as follows by Woo (1969):

high tone	35-38 csec.
rising tone	36-48 csec.
falling tone	23-31 csec.
low tone	52-61 csec.

[25] The tone contours given here are taken from Kratochvíl (1968).

[26] The tone contours given here are taken from Wang et al. (1967).

[27] I have written the syllables *zi* and *lü* with double vowels to indicate that they, like all stressed syllables in Mandarin, are bi-moraic.

[28] The data given here is taken from Woo (1969).

[29] I believe this analysis of the mid tone as a toneless syllable to be generally valid for languages with three lexically-contrasting tone levels.

[30] Notice that the "mid-high" rising tone (e) has been represented here as low-mid rising. It is necessary to represent this tone in this way in order to establish its relationship to its combination form (e'), as will be shown in (6-10) below.

[31] However, notice that because there is no ↑ at the end of an (f') low tone, a sequence of two such tones will have a pitch drop between them, and there will be no rise in pitch between this tone and a following mid tone. If these predictions of the

analysis should turn out to be untrue, then it would be necessary to postulate a ↑ at the end of the (f') low tone. However, this ↑ should not appear in the underlying representation of this tone, for then the rule of Tone Marker Retraction, to be introduced below, would generate the wrong isolation contour for this tone. If a ↑ should be found to be necessary at the end of this tone, then that ↑ could be inserted by a rule of the form

(xiv) [↓ ...]

s.d. 1 2

s.c. Insert a ↑ after 2.

This rule would be ordered after the rule of Tone Marker Retraction ((6-9) below). Notice that rule (xiv) would also insert a ↑ at the ends of the isolation low tones (f) = ↓μμ and (h) = ↓μ. Without data showing the exact realization of these tones in all contexts, it is impossible to know whether or not tone (f)∿(f') constitutes a problem for the analysis.

[32] It is this derivation which motivates the representation of the rising tone (e) as a LOW-high rising tone rather than as a mid-high rising tone, as it is described by Woo (1969).

CHAPTER III

PHRASAL TONE: THE INTONATION CONTOURS OF ENGLISH

We have now looked at a number of languages in which all or most of the lexical items of the language have their own characteristic tone contours, with the tone contour of a phrase obtained (more or less) by combining the tone contours of the lexical items which make it up. In a language of this sort, the tone rules which apply at the surface level are primarily rules of tone-simplification and tone movement. Processes of the former type simplify the tone contour by deleting some of the lexically-introduced tone markers, and those of the latter type re-position the tone contour in relation to the phonological string. In all the languages we have looked at, we have seen only one example of a tone-insertion rule, and that is the rule which introduces a pitch rise after the first syllable of a phrase in Tokyo Japanese. However, in languages like English, which have no lexical tone, the entire tone contour must be assigned by rule at the surface level. In languages of this sort, we find primarily rules of tone-insertion, rather than the tone-movement and tone-deletion rules which are typical of languages with lexical tone.

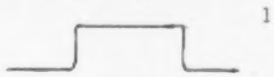
The most commonly-used intonation patterns of American English can be derived by means of the three rules given below:

(1) a. $\emptyset \rightarrow \downarrow \ / \ \begin{matrix}\sigma \\ [1\ \text{stress}]\end{matrix} \ \underline{\qquad}$

b. $\emptyset \rightarrow \uparrow \ / \ \underline{\qquad} \ \begin{matrix}\sigma \\ [1\ \text{stress}]\end{matrix}$

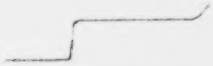
c. $\emptyset \rightarrow \uparrow \ / \ \underline{\qquad} \ \$$

Rules (a) and (b) above insert the rise and fall in pitch which surround the primary-stressed syllable in most statements of English. For example, the statement below would ordinarily be pronounced with a rise in pitch before the main-stressed syllable *rain*, and a drop in pitch after it:

(2) 

It's ↑ rain ↓ ing.

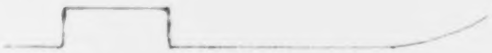
Rule (1-c) introduces the rise in pitch which appears at the end of a *yes/no* question such as



(3) It's ↑ raining↑?

or at the end of a suggestion or polite statement of disagreement, for example,

(4)



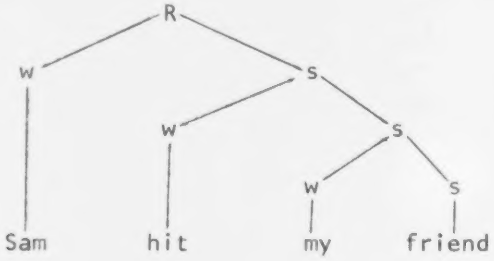
The ↑ blue ↓ one looks nice on you↑.[2]

The sentence above, pronounced with this intonation contour, might be a suggestion, in answer to the question "Which one do you think I should buy?" or an expression of disagreement, in response to the statement "All these swimming suits look terrible on me." Notice that all three tone-insertion rules have applied in (4). By choosing which rules to apply, and by varying the size of the tone-changes which they introduce, the speaker indicates whether he is certain or tentative, excited or bored, and whether or not he desires a response from his listener.[3]

Compare this method of assigning the intonation contour of an English sentence with that proposed by Liberman (1975). In Liberman's view, an intonation contour such as the LHL contour which he calls the "surprise/redundancy tune" exists as a lexical entity, as an ideophonic "word" of a special sort.

An intonational melody becomes associated with a sentence of English through the mediation of a "metrical tree", which is a device for assigning a stress pattern to an English sentence. The metrical tree identifies one constituent of every phrase as the "strong" constituent, in relation to the other constituent of the phrase, which is "weak". For example, the sentence *Sam hit my friend* is associated with the following metrical tree, where "R" stands for "root" and "s" and "w" for "strong" and "weak":

(5)



The labelling of the nodes of the metrical tree above is determined by the following principle:

(6) In a configuration $[_C AB]_C$, where C is a phrasal category, B is strong.

This principle identifies the righthand constituent of each phrase as the strong one. Thus, in the sentence of (5), *friend* is the strong constituent of the NP *my friend*, *my friend* is the strong constituent of the VP *hit my friend*, and *hit my friend* is the strong constituent of the clause *Sam hit my friend*. The stress pattern which is obtained by the assignment of a metrical tree in conformance with principle (6) parallels that obtained in the *SPE* system by the cyclical application of the Nuclear Stress Rule. Thus the metrical tree above replaces the *SPE* stress-assignment shown below:

(7) [Sam [hit [my friend]]]

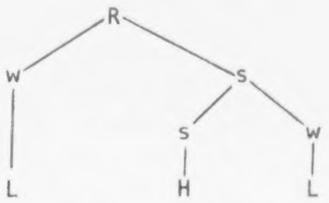
1	1	1	1	Lexical stress
		2	1	Nuclear Stress Rule, Application 1
	2	3	1	Nuclear Stress Rule, Application 2
2	3	4	1	Nuclear Stress Rule, Application 3

Both the *SPE* system and the metrical tree system must have special rules to deal with emphatic and contrastive stress, cliticization processes which bring about reduction of stress, reduction of stress on redundant elements of the sentence, and readjustment of stress for purposes of rhythm. In addition, there must be a mechanism for extending the stress-assignment process inside lexical items, in order to account for differences in stress level among the syllables of a word, a problem which we have avoided in (5) and (7) above by confining our vocabulary to monosyllabic words. We will not concern ourselves with any of those problems here, since our purpose is only to see how the notion of a metrical tree can be used in associating an intonation contour with the phonological string.

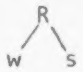
All the information which is contained in the *SPE* stress-level numbers of (7) is also encoded in the metrical tree of (5). In fact, it is possible to translate a metrical tree into stress-level numbers by counting the number of nodes which dominate the lowest *w* which dominates each element -- that number plus one is the same as the stress-level number which would be assigned to that element in the *SPE* system. (See Liberman and Prince (1977), p. 259). The element which is dominated only by s's in the metrical tree is the same as the primary-stressed element of the *SPE* system. This element is called the "designated terminal element".

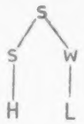
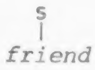
Although they encode the same information as the numerical stress-assignment rules of *SPE*, Liberman's metrical trees can be used to perform a function which the *SPE* stress-assignment system could not perform -- they can be used to match the tones of an intonation melody onto a phonological string. In particular, Liberman hypothesizes that intonation melodies have metrical trees, just as phonological phrases do, and that an intonation melody is matched with a phonological phrase by matching its metrical tree with that of the phrase. (The metrical tree of an intonation melody is assigned lexically rather than by means of rules like those which govern the assignment of a metrical tree to a phonological phrase.) To give an example, the "surprise/redundancy" melody, LHL, has the lexically-assigned metrical tree

(8)

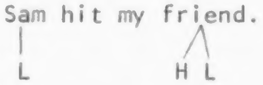


and this tree is matched with the metrical tree of sentence (5) in the following way:

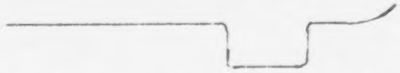
The  portion of the two metrical trees is identical,

and so these portions of the two metrical trees are matched to one another. Going down one step, we find that the metrical tree of the intonation melody has the trochaic structure [sw] while the tree of the sentence has the iambic structure [ws]. The principles of tree-matching tell us in such a case to slide the trochaic node down to the strong branch of the iambic node, and to continue on in this way until we get a match. In this particular case, we never do get a match, and so the  portion of the tone melody is matched with the  portion of the sentence, establishing the melody-text association shown below:

(9)



One advantange of Liberman's system of text-tune association is that it provides an explanation for the frequently-observed fact that the main-stressed syllable of a phrase of English tends to differ in tone from the syllables which surround it, whether the contour is of the rising-falling variety which is typical of statements, or a falling-rising contour of the sort found in *yes/no* questions in British English; for example,

(10)


Would you like ↓ bis ↑ cuits↑?

To see how Liberman's theory accounts for this fact, notice that the designated terminal element of the intonation melody (i.e., the tone segment which is dominated only by s's) is necessarily paired with the designated terminal element of the phrase (i.e., with the main-stressed syllable). Consequently, if adjacent segments of the intonation melody are different from one another (as one assumes they will be) then the main-stressed syllable of the phrase must have a tone level different from that of the syllables which surround it. Thus in Liberman's system, the fact that changes in tone level tend to occur in the vicinity of the main-stressed syllable is a consequence of the process of tone-assignment.

The same cannot be said of the dynamic-tone analysis which is outlined in (1). Here there is no necessity that it be the main-stressed syllable which is surrounded by tone-change markers; the system requires only that the syllable which is treated in this way must be easily distinguishable from other syllables of the phrase. For example, the rules would be only slightly more complex if it were the third syllable of the phrase which was surrounded by tone markers, rather than the main-stressed syllable.

While the affinity between stress and tone changes appears to provide an argument for Liberman's level-tone theory of English intonation as opposed to the dynamic-tone analysis given in (1), this argument does not hold up when we consider a wider range of languages, for the same affinity between stress and tone changes (or, taking the opposite point of view, the same incompatibility between tone changes and UNstressed syllables) is also found in languages whose tone contours could not be assigned by the tree-matching process which Liberman proposes for English. For example, we have seen that unstressed syllables in Mandarin are toneless, and that there are rules in both Mandarin and Chaochow which move tone markers away from the beginning of an unstressed syllable. Thus the tendency for tone changes to take place in the vicinity of stressed syllables exists not only in English, but also in languages whose tone contours are lexically-assigned. These facts suggest that the clustering of tone changes at the boundaries of stressed syllables in English must be accounted for by some generally-applicable linguistic principle rather than by a mechanism for tone-assignment which is by nature restricted to intonational languages.

To take an example of a different sort, Hale, Jeanne, and Platero (1977) have described the tone contours of Papago in the following way:

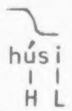
(11) a. The first stressed syllable of the phrase, the last stressed syllable of the phrase, and all the syllables between them have high tone.

b. Every syllable between the last stressed syllable of the phrase and the end of the phrase has low tone. If the last syllable of the phrase is stressed, then it carries a falling glide, from high to low.

c. If the first syllable of the phrase is unstressed, then it and all the syllables between it and the first stressed syllable of the phrase are low-toned.

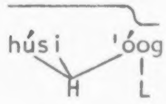
Some examples are given below, with stressed syllables marked with a "´".

(12) a.



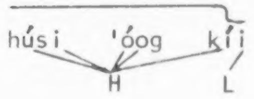
'Joe'

b.



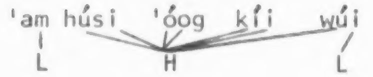
'Joe's father'

c.



'Joe's father's house'

d.



'to Joe's father's house'

The facts above could also be described in dynamic-tone terms, in the following way:

(13) a. There is a ↓ after the last stressed syllable of the phrase, that is

$ P σ [+stress]
s.d. 1 2 3, where P is the maximal string of units
s.c. Insert a ↓ after 3.

(13) b. There is a ↑ before the first stressed syllable of the phrase, that is,

σ P $
[+stress]
s.d. 1 2 3, where P is the maximal string of units
s.c. Insert a ↑ before 1.

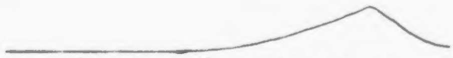
c. A tone marker at the end of a phrase is realized as a gliding tone on the syllable which precedes it. A tone marker at the beginning of a phrase is not pronounced.

Now observe that in the tone contour of a phrase of Papago, changes from one tone level to another take place at the boundaries of stressed syllables, just as they do in English, though there is no reason to believe that the tone contours of Papago phrases should or could be assigned by matching metrical trees. Thus, although it is likely that the last stressed syllable of the phrase is the most heavily stressed (Hale, Jeanne, and Platero state that this is impressionistically the case) so that the position of the fall from high to low is correctly predicted by Liberman's theory, the position of the rise from low to high is not. These facts suggest that there must be a principle somewhere in the theory stating that tone changes tend to occur at the boundaries of tone-bearing units which are stressed and not at the boundaries of tone-bearing units which are unstressed. This affinity between stress and tone changes presumably arises from the fact that it takes some time to make a change in pitch, so that it is easier to make and perceive pitch changes at the boundaries of stressed units, which are relatively long in duration. This general principle, which will apparently be needed in any case, accounts for the fact that it is the main-stressed syllable of the phrase, and not some other syllable, which is surrounded by tone-change markers in English. Thus it is not necessary that the system of tone assignment itself should predict a difference between the tone level of the main-stressed syllable and that of surrounding syllables.

Now let us consider the meanings of the intonation contours of English. In keeping with his view of intonation contours as lexical items of a special sort, Liberman attaches a meaning to the intonation contour as a whole, though he recognizes that a particular part of the contour may be primarily responsible for some particular part of the meaning, just as an individual morpheme contributes to the meaning of the word in which it appears. For example, Liberman observes that the tone melody LHL is appropriate either when the speaker is expressing surprise, as in

(14) (taken from Liberman)

Speaker walks into a room, is shocked by the paint job, and says:



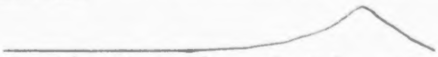
"My god -- the blackboard's painted orange!"

or when the speaker is "suggesting that the utterance is redundant or unnecessary", as in

(15) (also from Liberman)

Speaker A: "What color is the blackboard?"

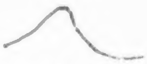
Speaker B: "I've told you a thousand times --



the blackboard's painted orange!"

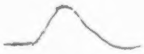
I believe this intonation pattern has a much less specific meaning than is suggested by Liberman's "surprise/redundancy" annotation; in fact, the following examples suggest that it is appropriate to an utterance which expresses strong emotion of any sort, especially one which expects a response from the listener.

(16) a.



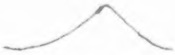
I hate you!

b.



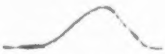
I love you!

c.



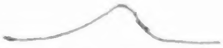
Don't do that!

d.



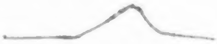
Let's do it!

e.



That's wonderful!

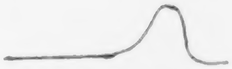
f.



That's terrible!

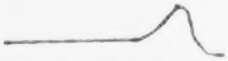
For that reason, I would attach a much vaguer meaning, something like "strong emotion with hope of response from listener" to a pitch contour of this shape in English. Moreover, I think it is far from clear that this meaning resides in the intonation contour AS A WHOLE; instead, it seems to be associated entirely with the early part of the contour, the ↑. Thus, as the emotional involvement of the speaker decreases, we find a corresponding decrease in the size of the pitch rise of the contour, as in the examples

(17) a.



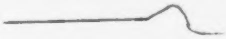
That's terrific!

b.



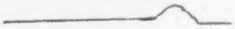
That's terrific!

c.



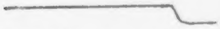
That's terrific.

d.



That's terrific.

e.

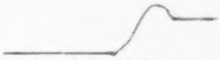


That's terrific.

in which the level of emotion expressed by the intonation contour decreases pretty steadily from the highly emotional (a) to the stone-faced (e). The "size" of a pitch change must, of course, be judged in relation to the amount of pitch space which is available at the point at which the change takes place. Thus, in absolute terms, the size of the pitch rise in (c) is about the same as that of (d), but (c), which is the "neutral" statement intonation contour of English, lacks the laconic, uninterested feeling of (d) because, having started on a higher pitch level to begin with, the speaker has less room to go up than if he had started on a lower pitch level. On the other hand, I would not want to say that the absolute size of the pitch change is altogether irrelevant -- if I want to REALLY express emotion I have to begin on a low enough pitch level to allow a substantial rise in pitch.

Now observe that while a decrease in the size of the ↑ of the intonation contour decreases the amount of emotion it expresses, a decrease in the size of the ↓ does not. Thus it is possible to say with uncertainty and great distress

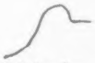
(18)



I don't think so ...

The diminution in the size of the ↓ of the contour of (18) expresses a decrease not in the degree of the speaker's emotional involvement, but in the degree of finality with which he speaks. Liberman points out that the reduced pitch drop is appropriate to vocatives such as

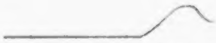
(19)



Alicia

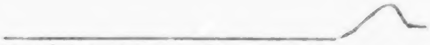
and to jocular or menacing admonitions

(20) a.



Cover your ears!

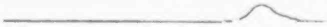
b.



You'd better give me the money (or you'll be sorry).

The abbreviated pitch drop is also found in tentative or unfinished remarks such as

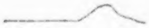
(21)



I've brought the pepper... (but did I remember the salt?)

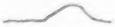
and in clauses and other adverbial elements which introduce a sentence

(22) a.



If it rains, we won't be able to go.

b.



Tomorrow I'll take you downtown and buy you some new mittens.

The examples of (21) and (22) would ordinarily differ from those of (18) and (20) in having a smaller pitch rise, reflecting their lesser emotional content. The vocative of (19) may have either a large ↑ or a small one, a difference which Liberman attributes to proximity, the version with the larger ↑ being more appropriate when Alicia is further away. This change of meaning is an instance of the effect which is obtained quite generally by increasing the size of the ↑ of the contour -- an increase in the demand for a response from the listener. Thus the larger ↑ is appropriate when Alicia is further away, because the speaker must make a greater effort to attract her attention.

In this discussion of the meanings of intonation contours, it has not been necessary at any point to attribute meaning to the intonational melody AS A WHOLE. Instead, the ↑ of the intonation contour has been said to indicate the speaker's emotional involvement and/or desire to attract the listener's attention, and the ↓ has been said to express the degree of definiteness and finality with which the utterance is made. In this view, the meaning of the whole contour is a sum of the meanings of its parts -- a sort of Fregean view of intonation contours. But if there is no need to assign meaning to the intonation contour as a whole, then there is also no need to suppose that the intonation contour is a lexical unit -- the intonation contour need not exist as a unit except in connection with a phonological phrase.

This view leaves open the possibility that something must be said somewhere in the grammar about the meaning of an individual pitch change which is introduced into a phrase at some particular point. However it is likely that very little needs to be said about this, for as Liberman points out in the passage which is quoted below, the meanings of rises and falls in pitch in intonation contours arise in large part from a more general symbolic significance which we attach to rising and falling gestures.

> We have a sense that "rising" gestures in general share some property by opposition to "falling" gestures. Weak and strong beats in music are conceived of as rising and falling respectively (*arsis/thesis*, *levatio/positio*, *upbeat/downbeat*, etc.) In dance, rising up on the toes is generally an arsic gesture, while coming down flat-footed is generally thetic. Raising the eyebrows is an other-directed gesture (greetings, expressions of skepticism, etc.), while lowering the eyebrows is a more self-directed gesture (signalling concentration, etc.). In sign languages, questions, nonterminal pauses, etc. are usually signaled with an upward motion of the hands, while more "final" terminations are signaled with a downward motion (superimposed on whatever signs are being employed in the "utterance"). Examples could be multiplied indefinitely; the point is simply that "rising" and "falling" have some general metaphorical value independent of any role they may play in intonation, and that the roles which can in general be attributed to these concepts in intonation (e.g., *other-directed* vs. *self-directed*, *nonfinal* vs. *final*) are exactly what would be expected on the theory ... that they are essentially paralinguistic metaphors.

Liberman's point is that the fact that much of the meaning of an intonation contour is contributed by the rising and falling patterns within it is not necessarily an argument for analyzing intonation contours as sequences of dynamic tones; the meaning which we attribute to a rising or falling pitch pattern in the intonation melody may be a paralinguistic meaning, since it seems to hold for rising and falling gestures in general. On the other hand, of course, the fact that rising and falling intonational gestures have much the same symbolic content as other sorts of rising and falling gestures is not an argument AGAINST representing tone contours dynamically; what is needed rather is an argument that features which designate pitch levels play a crucial role in determining the meaning of intonation contours.

Liberman tries to make an argument of this sort in his discussion of the LHL "surprise/redundancy tune". Liberman defines this and other intonational melodies of English as sequences of the four tone-levels

(23) $H = \begin{bmatrix} +\text{high} \\ -\text{low} \end{bmatrix}$ $H\text{-}M = \begin{bmatrix} +\text{high} \\ +\text{low} \end{bmatrix}$

$H\text{-}L = \begin{bmatrix} -\text{high} \\ -\text{low} \end{bmatrix}$ $L = \begin{bmatrix} -\text{high} \\ +\text{low} \end{bmatrix}$

which are arranged here in the order highest tone level → lowest tone level. In particular, he suggests that the "surprise/redundancy tune" has the tone-specification

(24) $\begin{bmatrix} -\text{high} \\ +\text{low} \end{bmatrix} \; [+\text{high}] \; \begin{bmatrix} -\text{high} \\ +\text{low} \end{bmatrix}$

with the middle tone segment (the one which is mapped onto the primary-stressed syllable of the phrase) left unspecified for the feature [±low]. Changing the value of the middle segment for this feature creates the difference between the "restrained" and "unrestrained" versions of this intonation pattern which are illustrated below:

(25) (Quoted from Liberman)

a. <u>Restrained Version</u>

Detective looks up from his examination of suspect's safe-deposit box, knits his brows, and says in a puzzled tone:

```
There isn't any money in it!  (expresses SURPRISE
      |           |     |      tempered by consider-
      L          H-M    L      ation of where else
                               the loot might be
                               stashed.)
```

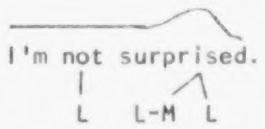
b. <u>Unrestrained version</u>

Same detective, same situation; his jaw drops, and he says in witless amazement:

```
There isn't any money in it! (expresses SURPRISE,
      |           |     |     simple and unalloyed.)
      L           H     L
```

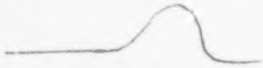
These two intonational patterns were also illustrated in (17a) and (17b). In Liberman's view, they differ in the value of the middle tone segment for the feature [±low], with the choice of [+low] giving the more restrained version, and the choice of [-low] the less restrained version. The problem with this treatment is that there is another contour illustrated below and in (17d), which seems to be a still more restrained version of THE SAME BASIC CONTOUR.

(26)


I'm not surprised.

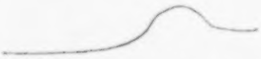
Liberman apparently shares my feeling that this intonation contour is a third verison of the same basic contour, for he calls it "the lowest possible spelling of the rising-falling gesture." However, in that case the emotional restraint which is introduced into the contour of (25 a) by specifying its middle tone segment as [+low] cannot be attributed to the [+low] specification itself, for by changing that segment to [-low] (in combination with [-high]) we get the still more restrained version of (26). The dynamic-tone theory allows a more natural treatment of the progression from most emotional to least emotional which we find in examples (25a), (25b), and (26), for it allows us to relate this progression to a continuous decrease in the size of the ↑ of the intonation contour. The progressive decrease in definiteness and finality in the utterances below is treated in the same way, as the result of a progressive decrease in the size of the final ↓:

(27) a.



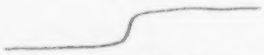
Here's a green one.

b.



Here's a green one... (I don't know if that's the color you want.)

c.



Here's a green one...(and here's a yellow one)

Consider, by way of contrast, the level-tone specifications which would have to be given for the contours of (27) in a level-tone system like that proposed by Liberman:

(28) a. L H L or L H-M L (for (27a))

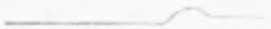
b. L H H-M or L H-M L-M (for(27b))

c. L H-M H-M (for (27c))

There is no systematic difference in the representations above which corresponds to the progressive decrease in finality from (27a) to (27c).

Incidentally, it should not be thought that there is no possibility of varying the size of the pitch drop in a contour like that of (26), though its level-tone representation might lead one to think that that was the case, since the only tone lower than a L-M is a L. It is, of course, possible to be laconic and tentative at the same time, as in

(29)



Well if you say so...

Liberman does not say how he would fit this intonation contour into his system, though from what he says about other, similar cases, I assume that he would represent it as

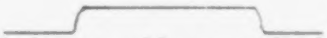
(30) L L-M L-M

with a convention that there is a drop in pitch between two contiguous, identical tone segments. (The addition of this convention would, of course, require a change in the representation of (28c).) Although a convention of this sort would provide a way of representing the tone contour of (26), this is rather a make-do solution, I feel, since one could not claim that the convention is a universal one, and so the theory at least predicts the possibility of a language exactly like English except that it would NOT be possible to drop down just half-way in phrases with the tone contour of (26). For that reason, and because the meanings of intonation contours correlate so closely with the direction and size and location of their pitch changes, I believe that the intonation contours of English should be represented in dynamic terms. I have assumed here, though it is not a necessary part of the theory, that the meanings of the individual tone changes of an intonation contour derive in large part from some "general metaphorical value" of rising and falling gestures. If this assumption is correct, then we may expect that languages which use tone intonationally (i.e. to express an attitude toward the content of an utterance rather than to characterize words or to mark syntactic structure) will differ much more in where and when they insert tone markers into the string than in what those tone markers add to the meaning of the utterance once they have been inserted.

FOOTNOTES TO CHAPTER III

[1] The pitch rise of the intonation contour does not always come at the boundary of the main-stressed syllable, but may be placed earlier in the phrase, at the boundary of another heavily-stressed syllable, as in the example

(i)

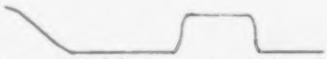


It's ↑ really pour↓ing!

[2] The terminal pitch rise is anticipated somewhat in a sentence like this one, where the distance between the main-stressed syllable and the end of the phrase is long. See the discussion of "corner-cutting" in Chapter 1, section 3.

[3] There must also be some other rules. For example, there must be a rule to introduce the phrase-initial pitch drop which is found in examples like Liberman's

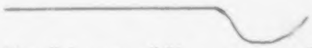
(ii)



↓an English ↑ tea↓cher! (Chapter 1, section 3).

In addition, in British English, there is sometimes a ↓ before the main-stressed syllable and a ↑ after it, as in the *yes/no* question

(iii)



Would you like ↓ tea↑?

I have not tried to give an exhaustive list of the tone-insertion rules which will be needed for English, but only the most important ones, as an example of what SORTS of rules will be needed.

CHAPTER IV

TONE RULES

I. Introduction

The dynamic-tone theory which has been proposed here provides for the expression of the following sorts of tone rules:

(1-1) a. rules which insert tone markers

b. rules which delete tone markers

c. rules which move tone markers

d. rules which change the feature composition of tone markers (i.e. rules which change a ↓ into a ↑ or a ↑ into a ↓).

e. rules which introduce greater phonetic detail into the feature composition of tone markers (i.e. rules which adjust the size of the pitch change which a tone marker represents).

Of these logically-possible sorts of rules, we have found examples of all except (d). We have found no rules of type (d), nor should we expect to find any, for the following reason: A rule which changes the feature composition of a segment is a formal expression of a process of assimilation or dissimilation which makes one phonological unit more like (or more unlike) some other phonological unit in its immediate environment. But processes of assimilation and dissimilation must, by their very nature, apply to units which represent end-point configurations; we should not expect units like tone-change markers, which represent RELATIONSHIPS between end-point configurations, to undergo processes of assimilation and dissimilation.

In this chapter, I will briefly review some representative examples of each of the rule-types (a), (b), (c) and (e), so that we can observe (i) what features of the phonological and tonal environment give rise to each process, and (ii) what constraints limit the operation of particular tonal processes or of tonal processes in general. One important question about tonal processes -- their interaction with the syntactic environment -- will not be dealt with here, but will be the subject of Chapter VIII.

2. Rules Which Insert Tone Markers

In the preceding chapters, we have found evidence for the following rules of tone-insertion:

(2-1) For American English

a. $\emptyset \rightarrow \downarrow \; / \; \underset{[1\ \text{stress}]}{\sigma} \; \underline{\qquad}$

b. $\emptyset \rightarrow \uparrow \; / \; \underline{\qquad} \; \underset{[1\ \text{stress}]}{\sigma}$

c. $\emptyset \rightarrow \uparrow \; / \; \underline{\qquad} \; \$$

(2-2) For Papago

a. $\emptyset \rightarrow \downarrow \; / \; \$ \; P \; \underset{[+\text{stress}]}{\sigma} \; \underline{\qquad}$

b. $\emptyset \rightarrow \uparrow \; / \; \underline{\qquad} \; \underset{[+\text{stress}]}{\sigma} \; P \; \$$

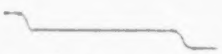
(where P represents the maximal string of units)

(2-3) For Tokyo Japanese

$\emptyset \rightarrow \uparrow \; / \; \$ \; ([C_o \; V]_\sigma) \; \underline{\qquad} \; \sigma$

The rules above insert tone markers into the surface string in the environment of a stressed syllable or a phrase boundary.[1] Evidence for the existence of such rules is fairly strong, particularly in the English and Japanese cases. There are two reasons why it would be difficult to assign the pitch rise of the tone contour of Tokyo Japanese in some other way, for example, as part of the lexical tone contours of individual words. One is that the pitch rise does not appear when the word is not at the beginning of a phonological phrase; for example, there is no pitch rise after the first syllable of *oyo↓gi* 'swimming' in the phrase below when it is pronounced at normal conversational speed:

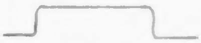
(2-4)



u↓mi-de oyo↓gi 'swimming in the sea'

The second reason is that the position of the pitch rise is affected by properties of the string which may have been altered by the application of rules. For example, it is normally the case that nouns like *ʔi↓noti* 'life', which have a pitch drop after the first syllable, get their pitch rise at the beginning of the word, in contrast to other words with initial short syllables, in which the pitch rise comes after the first syllable of the word. However, there are particles in Japanese which cause the deletion of the lexical pitch drop of the preceding noun. The particle *gu↓rai* 'as much as' has this property in some dialects, as can be seen from the phrase below:

(2-5)

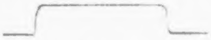


ko↑koro gu↓rai (from *koko↓ro* + *gu↓rai*)

'as much as a heart'

The following example shows that the position of the ↑ of the tone contour is determined after the application of the rule which deletes the ↓ of a noun before *gu↓rai*, for in this phrase *ʔi↓noti* behaves like a noun with no ↓ after its first syllable:

(2-6)

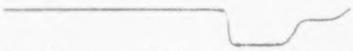


ʔi↑noti gu↓rai (from *ʔi↓noti* + *gu↓rai*)[2]

While these facts do not categorically rule out an analysis in which the pitch rise near the beginning of a phrase of Tokyo Japanese is part of the lexical representation of the first word of the phrase, they are far more easily accounted for in a system which inserts this pitch rise at the surface level, after the position of phrase boundaries has been determined, and after the application of the rule which deletes the ↓ of a noun before a particle of the class of *gu↓rai*.

Similarly, there is reason to believe that the pitch changes which surround the main-stressed syllable in English must be inserted by surface-level rules, for if we were to assume, instead, that the tone contour [...↑σ↓...] is assigned to each word in lexical representation, with the contours of all but the most heavily stressed word of the phrase being deleted at the surface level, then we would have difficulty in accounting for the fact that the contour which is associated with the most heavily stressed word of the phrase is not always [...↑σ↓...], but also sometimes [...↓σ↑...], as in the question

(2-7)



Would you like ↓cof↑fee↑?

The tendendy of tone-insertion rules to insert their tone-change markers at the boundaries of stressed syllales was discussed in Chapter III.

3. Rules Which Move Tone Markers

The tone-movement rules which have been motivated in the preceding chapters fall into the following three categories: (i) rules which retract tone markers, (ii) rules which move a tone marker a specified distance to the right, and (iii) rules which move a tone marker indefinitely far to the right. I will discuss these rule-types in the order in which they are listed here.

3.1 Rules which retract tone markers. The rules of tone-marker retraction which have been motivated in the preceding chapters are listed below:

(3.1-1) ↑-Retraction (Mende)

σ σ ↑ (↓ ...) ##

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

(3.1-2) ↑-Retraction (Igbo)

σ σ ↑ (#) (#) ↓

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

Condition: If 4 and 5 are both present, then 2 is not long.

(3.1-3) ↑-Retraction (Mandarin)

σ σ ↑ (#) (#) ↓

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

(3.1-4) Tone Marker Retraction (Chaochow)

[...μ[+tone]...]

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

Condition: This rule applies at the end of a phrase or before an unstressed syllable.

The first three rules above are virtually identical to one another, in that all three rules pull a ↑ back one tone-bearing unit when it would otherwise be followed by a ↓. In Mende, a ↑ is retracted also at the end of a phrase, and not just before a ↓. The Chaochow rule retracts either a ↑ or a ↓, and applies either at the end of a phrase or before an unstressed syllable. Generally speaking, however, it is ↑'s which are retracted, rather than ↓'s. The retraction rules which have been motivated here act to prevent the occurrence of a ↑ and a ↓ at the same boundary, or the occurrence of a tone change at the end of a phrase or at the boundary of an unstressed syllable.

3.2 Rules which move a tone marker a specified distance to the right. Two rules of Igbo which move a tone marker one syllable to the right are listed below:

(3.2-1) ↓Metathesis (Igbo)

$[_{NP}\downarrow[+\text{syll}] \ldots \downarrow]$

s.d. 1 2 3 4, where 3 contains no tone markers.

s.c. Transpose 1 and 2.

(3.2-2) Syllabic-nasal Raising (Igbo)

$\#\# \ [+\text{tone}] \begin{bmatrix}+\text{syll}\\+\text{nas}\end{bmatrix} [+\text{nas}]$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

The rules above move a word-initial tone marker into word-internal position when the syllable following the tone marker consists of a high-toned syllabic segment only, or is a syllabic nasal with a nasal consonant after it. The fact that these rules do not apply when the syllable following the tone marker contains an initial consonant is probably attributable to the relatively longer duration of such syllables as compared to syllables which contain only a syllabic segment.

Insofar as they move a word-initial tone marker to the right when the following syllable is relatively short in duration, the Igbo rules above closely resemble certain historical processes of Japanese. For example, we have seen that the pitch rise of a phrase of Tokyo Japanese comes after the first syllable of the phrase if that syllable is short, as in

(3.2-4)

ko↑ko↓ro 'heart'

but at the beginning of the phrase when the first syllable is long, as in

(3.2-5) ———

↑kooban

The position of the ↑ in (3.2-4) is presumably the result of an historical process which moved a phrase-initial ↑ to the right just in case the following syllable was short.

The Matsue dialect of Japanese provides another example of a similar sort. According to Haraguchi (1975), a word of Matsue contains a rise in pitch which comes after the first syllable if that syllable is short and is followed by a syllable with a low vowel:

(3.2-6) o / tosimono↓ga 'lost property' + nominative marker

However, if the word begins with a short syllable followed by one or more syllables with high vowels, then the ↑ comes after this whole string of syllables, as in

(3.2-7) a. kami↑ga 'paper' + nominative marker

b. harisi/go\to-ga 'needle work' + nominative marker

The principle above holds unless following it would place the ↑ at the end of the word; in that case the ↑ is placed one syllable before the end of the word, as in

(3.2-8) ka/mi 'paper'

Finally, if the first syllable of the word is long, or if it is followed by a ↓, then the ↑ of the tone contour comes at the beginning of the word, as in

(3.2-9) a. ↑kenbikyoo 'microscope'

b. ↑ka\buto 'helmet'

The variation in the position of the pitch rise in a lexical item of Matsue can be stated formally by means of the lexical structure condition below:

(3.2-10) A word of Matsue has the tonal structure

$$\underset{1}{[(([C_0V]_\sigma)}\underset{2}{([C_0 \underset{[+high]}{V}]_\sigma)_Q}\ \underset{3}{\uparrow}\ \underset{4}{\ldots}\ \underset{5}{(\downarrow}\underset{6}{\ldots)]}$$

where $4 \neq \emptyset$, and where 4 and 6 contain no tone markers.

While I assume that the tone shape of a word in Matsue is determined in the lexicon and not by a surface-level rule, the position of the ↑ within the word is probably the result of a historical process which moved a ↑ to the right over a syllable with a high vowel. Here again, we see a connection between the duration of a syllable and its permeability to a process of tone movement, for Lehiste (1970) points out that, other things being equal, a syllable with a high vowel is significantly shorter in duration than one with a non-high vowel.

The permeability of a syllable with respect to processes of tone-movement may also be affected by the nature of its consonants, as shown by Hyman and Shuh (1974), who give examples illustrating a tendency for a voiceless obstruent to block the rightward progress of a ↑, while a voiced obstruent blocks the movement of a ↓. The examples below, from Nupe, a language of Nigeria, are taken from Hyman and Shuh. I have translated their level-tone representation into dynamic-tone terms:

(3.2-11) a. ↑pa 'peel' ↓e↑pa 'is peeling'

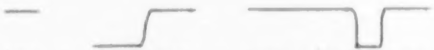
b. ↑ba 'be sour' ↓eba↑ 'is sour'

c. ↑wa 'want' ↓ewa↑ 'wants'

The examples above illustrate a lexical process in Nupe which transposes a word-internal ↑ with the following syllable UNLESS THAT SYLLABLE BEGINS WITH A VOICELESS OBSTRUENT, as in (a).

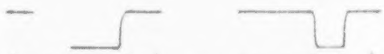
As an example of a case in which a tone-spreading process is blocked by the presence of a voiced obstruent, Hyman and Shuh provide the following data from Ngizim, another Nigerian language. Again, I have translated the representations given by Hyman and Shuh into dynamic-tone terms.

(3.2-12) a.



↑na + ↓kaa↑suw → ↑na ka↓a↑suw 'I swept'

b.



↑a + ↓rəp↑ci → ↑a rə↓p↑ci 'open'[3]

These examples show that a word-initial ↓ is moved one mora to the right in Ngizim when the consonant which follows it in the underlying form is a voiceless obstruent or a sonorant.[4] However, the rule does not apply when the consonant which follows the ↓ is a voiced obstruent, as can be seen from the following example:

(3.2-13) ↑na + ↓ba↑kə + ↓tlu↑wai →

↑na↓ba↑kə tlu↓wai 'I roasted the meat.'

The examples above from Nupe and Ngizim suggest that there is an inherent affinity between a pitch drop and a voiced obstruent and between a pitch rise and a voiceless obstruent, so that tone-movement rules which otherwise apply quite generally may be blocked when they would move a ↑ over a voiceless obstruent or a ↓ over a voiced obstruent. This affinity between certain consonant types and certain pitch change markers holds not only with regard to tone-movement processes, but with regard to other tonal processes as well. For example, Maran (1971) has shown that the tone of a closed syllable of Jingpho, a language of Burma, is determined by the final consonant: syllables closed by voiceless consonants are high-toned, while those closed by voiceless consonants are low-toned. Similarly, Welmers (1970) has pointed out that bi-syllabic words with the tone contour H'H in Igbo invariably have voiced medial consonants, a fact which suggests that the drop in pitch in these words is conditioned by the consonant. Some examples are given below:

(3.2-14) e↓go↓ 'money' ọ↓gụ↓ 'twenty'
e↓ze↓ 'tooth' a↓gụ↓ 'leopard'
e↓lu↓ 'top' ọ↓jị↓ 'kola nut'

The examples which have been given here suggest a fundamental difference between the two characteristics of the segmental string which affect the application of tone-movement rules -- namely, the duration of the tone-bearing units which are to be moved over and the nature of the consonants which appear inside them. While the duration of a tone-bearing unit affects its permeability to tone-movement processes in general, whether the tone marker being moved is a ↓ or a ↑, the consonants in the string create environments in which certain pitch changes are particularly natural, so that, for example, a drop in pitch is more likely to be found near a voiced obstruent in lexical representation, and is less likely to be moved away from it by processes of tone-movement. This affinity between certain consonant types and certain tone changes should presumably be expressed formally in terms of features;[5] that is, pitch-drop markers and voiced obstruents must have the same value for some feature, F_i, for which voiceless obstruents and pitch-rise markers have the opposite value. This idea is an interesting one, because it suggests that even phonological segments have some dynamic features. However, I have no specific proposal to make in this regard at this time.

3.3 Rules which move a tone-marker indefinitely far to the right. In the preceding chapters, we have found evidence for the following rules which move a tone marker indefinitely far to the right:

(3.3-1) ↑-Shift (Osaka Japanese)

... ↑Q # ...

s.d. 1 2 3 4 5 6 7

s.c. Move 3 to the right of 4.

Conditions: (i) $2 \neq \emptyset$

(ii) Q contains no tone markers.

(3.3-2) ↓-Displacement (Kikuyu)

↓ ↓ ... ↑

s.d. 1 2 3 4 5

s.c. 3 replaces 5.

Condition: 4 contains no tone markers.

Notice that both the Osaka rule of ↑-Shift and the Kikuyu rule of ↓-Displacement are subject to the condition that the string over which the tone marker is moved may not contain a tone marker. These rules call attention to a general constraint on tone-movement rules -- that they do not move one tone marker over another. In other words, we do not find tone-movement rules like the hypothetical rule below:

(3.3-3) $\uparrow\ \ldots\ \downarrow\ \sigma$

s.d. 1 2 3 4

s.c. Move 1 to the right of 4.

This constraint on tone-movement rules is just one manifestation of a constraint on tone rules in general -- that the phonological and tonological units to which they refer and the structural changes which they create are limited to that portion of the domain which begins with the tone marker which most immediately precedes the target tone marker and ends with the tone marker which most immediately follows it. In this sense, tone rules are "local" in their application. Thus I would not expect to find a tone-movement rule like that of (3.3-3), which moves the target tone marker over the tone marker to its right. Nor would I expect the tone marker two places before the target tone marker to serve as a context predicate. For example, I would not expect to find a rule of the form

(3.3-4) $\downarrow\ \ldots\ [+\text{tone}]\ \ldots\ \downarrow\ \sigma$

s.d. 1 2 3 4 5 6

s.c. Transpose 5 and 6.

It would be nice to be able to say that except for the specification of its domain, a tone rule may make no reference at all to material which lies outside the string which includes the target tone marker and the tone markers which most immediately precede and follow it. Unfortunately, that constraint appears to be too strong, for one does find references of a very limited sort to the string outside these bounds. For example, in Chapter VI I will argue for a tone deletion rule in Igbo which is stated as follows:

(3.3-5) $_{[+N]}[[+\text{syll}]\ \downarrow\ \sigma\ \downarrow\ \ldots]$

s.d. 1 2 3 4 5, where $5 \neq 0$.

s.c. Delete 2.

This rule deletes a ↓ which is preceded by a single syllabic segment and followed by "↓σ" within a nominal phrase which contains three or more syllables in all. In order to state the condition on the length of the phrase, it is necessary to specify that term 5 of the structural description may not subsume an empty string. But term 5 lies outside the usual sphere of operation for a tone rule.

The Kikuyu rule of End-of-phrase Lowering, repeated below:

(3.3-6) End-of-phrase Lowering (Kikuyu)

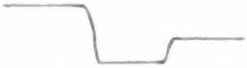
↓ ... $

s.d. 1 2 3 s.c. 1 > large

Condition: 2 contains no ↓.

is another case in point, for it is necessary to include in the structural description of this rule the condition that term 2 contains no ↓. (In other words, the target ↓ must be the last ↓ of the phrase.) However, it is possible for term 2 to include a ↑, as in the phrase below, whose analysis with respect to rule (3.3-6) is indicated below the phrase:

(3.3-7)



↑ne ke↓γire↑reria $ 'hindrance' (assertion)

1 2 3

The relevance of this example to the present discussion is the fact that it is necessary to state a condition on the composition of term 2 of the rule, which, in this case, subsumes a string which extends beyond the tone marker to the immediate right of the target tone marker. Thus, again, we see that it is not possible to avoid all reference to the composition of the string which lies beyond the tone markers which immediately precede and follow the target tone marker.

Nevertheless, while it is apparently not possible to exclude ALL references to the string outside the usual sphere of operation of a tone rule, such references are at least of a very limited sort. Perhaps they are always negative conditions like those which appear in rules (3.3-5) and (3.3-6).

Returning to the properties of tone movement rules in particular, it should be noted that rules which move a tone marker to the right are more common and appear to need less provocation than those which move a tone marker to the left. I have found no rule which moves a tone marker indefinitely far to the left.

4. Rules Which Delete Tone Markers

I have found evidence for the following three sorts of tone-deletion rules: (i) rules which delete one tone marker in the immediate environment of another, (ii) rules which delete a tone marker at or near the end of a phrase, and (iii) rules which delete all but one of a sequence of like tone markers. I will discuss these three kinds of rules in the order in which they are listed here.

4.1 Rules which delete one tone marker in the immediate environment of another. The rules listed below are representative of the rules of this type which have been motivated in the preceding chapters:[6]

(4.1-1) Left Streamlining (Igbo)

σ [+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Delete 2.

Condition: If 3 and 4 are both present, then 1 is not long.

(4.1-2) Right Streamlining (Igbo)

↓ (#) ([+syll])[+tone]

s.d. 1 2 3 4

s.c. Delete 4.

(4.1-3) Streamlining (Chaochow)

$$\begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix}\begin{bmatrix}+\text{tone}\\ <-\text{fall}>\end{bmatrix}\ \ldots\ \$$$

s.d. 1 2 3 4

s.c. Delete 1.

The rules above, which I have called "streamlining" rules, simplify tone contours by thinning out tone markers which are crowded together in the string. I assume that in rules of this sort, all the material which intervenes between the controlling tone marker and the tone marker to be deleted must be optional; in other words, I would not expect to find a rule like that shown below, which deletes a tone marker two syllables away from the controlling tone marker, but not one which is only one syllable away:

(4.1-5) $\uparrow \rightarrow \emptyset \ / \downarrow \sigma\ \sigma$ ___

The Igbo rule of Streamlining (4.1-2) which deletes a tone marker across a syllable consisting of a single syllabic segment but not across a syllable which consists of a consonant and a vowel, suggests that rules of tone-deletion, like rules of tone-movement, apply more readily across syllables which are relatively short in duration. Notice that the application of rule (4.1-1) is affected by the duration of the syllable on the far side of the target tone marker. I do not know of any tone-deletion process which depends on the nature of the consonants which surround the target tone marker, though it seems likely that such processes may exist.

4.2 Rules which delete a tone marker at or near the end of a phrase. The rules below are representative of the rules of this type which have been motivated in the preceding chapters:

(4.2-1) Phrase-final-↓ Deletion (Igbo)

$\downarrow \rightarrow \emptyset \ /$ ___ \$

(4.2-2) End-of-Phrase-Downstep Deletion (Kikuyu)

$\downarrow \rightarrow \emptyset \ /$ ___ \$

I have nothing of interest to say about rules of this type except to point out that they seem to be extremely common in tone languages.

4.3 Rules which delete all but one of a sequence of like tone markers.

(4.3-1) Accent-Deletion (Tokyo Japanese)

[+tone] ... [+tone] ... ##

s.d. 1 2 3 4 5

s.c. 3 > $\emptyset$

(4.3-2) Like-Tone-Marker Deletion (Mende)

$$\begin{array}{lccccc} & \begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} & \ldots & \begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} & \ldots & \$ \\ \text{s.d.} & 1 & 2 & 3 & 4 & 5 \\ \text{s.c.} & 3 > \emptyset & & & & \end{array}$$

(4.3-3) Like-Tone-Marker Deletion (Igbo)

$$\begin{array}{lcccccc} & \begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} & \langle\#\#\rangle & \ldots & \begin{bmatrix}+\text{tone}\\ \langle+\text{fall}\rangle\end{bmatrix} & \ldots & \$\$ \\ \text{s.d.} & 1 & 2 & 3 & 4 & 5 & 6 \\ \text{s.c.} & 1 > \emptyset & & & & & \end{array}$$

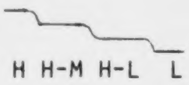
The rules of Like-Tone-Marker Deletion listed above are just a representative sample of the rules of this sort which have been motivated here; nearly every language we have looked at makes use of a rule of this type. Notice that these rules obey the constraint we observed in connection with tone-movement rules, whereby the sphere of operation of a tone rule is limited to the string which includes the target tone marker and the tone markers which immediately precede and follow it. Because this constraint holds for all tone rules, I have not included the condition that no tone marker may intervene between the controlling tone marker and the target tone marker in the statement of the individual rules above. There is a possible additional constraint on rules which delete one tone marker in the environment of another tone marker which is indefinitely far away, for in all the rules of this type which I have seen evidence for, the controlling tone marker and the target tone marker have the same value for the feature [±fall]. If this is invariably the case, then it is not necessary to specify this fact in the statement of each individual rule.

The role which rules of Like-Tone-Marker Deletion play in the grammar is clear -- by breaking up sequences of ↓'s or ↑'s, they insure that, in general, ↓'s will alternate with ↑'s within a single tone phrase, thereby permitting the language to incorporate a large number of pitch changes into a single tone contour while still remaining within a comfortable pitch range for the human voice. Rules of Like-Tone-Marker Deletion are not the only device which the theory provides for this purpose. Thus we also find restrictions on lexical tone contours which insure an alternation of ↓'s with ↑'s in the lexical representation of a word, or which at least severely restrict the conditions under which identical tone markers may appear in sequence inside a word. Rules of tone-marker insertion also contribute to the pattern of alternation of tone markers within a phrase; thus the tone-insertion rules of English insert a ↑ before the main-stressed syllable and a ↓ after it, and the rule of ↑-Insertion in Tokyo Japanese inserts a ↑ at the beginning of the phrase to counterbalance the ↓'s which are introduced in the lexical representations of the words.

Liberman (1975) has used the pattern of alternating ↓'s and ↑'s as an argument for representing tone contours as sequences of static tones rather than as sequences of dynamic tones. Liberman's argument is based on an observation by David Crystal, a proponent of dynamic tones, who observed that while rises and falls in pitch may succeed one another in the intonation contour, one never finds two rises in pitch or two falls in pitch in succession. If this observation is correct, Liberman argues, then that is evidence for a static-tone theory, because in a static-tone theory a fall in pitch must be represented by means of the sequence HL, and so the sequence "fall-fall" must be represented as HLHL, which automatically introduces a rise in pitch between the two falls.

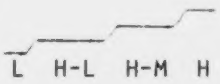
If Crystal's observation were correct, and there could never be two rises or two falls in pitch in succession within the same intonational phrase, then that fact would not choose between my theory and Liberman's, because Liberman's theory provides four pitch levels -- H, H-M, H-L, and L -- thereby allowing the expression of a sequence of three falls in pitch, as

(4.3-4)

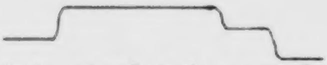


or a sequence of three rises in pitch, as

(4.3-5)



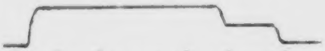
In fact, if it were true that such contours in fact never occurred, then it would be considerably easier to rule them out in my theory than in Liberman's, for in a dynamic-tone theory one can easily specify that two like tone-markers cannot occur in succession, but it is not easy to state a constraint against such contours in a level-tone theory like Liberman's. Fortunately for Liberman, it appears that the observation is not correct, for Liberman himself gives examples of intonation contours which contain a sequence of drops in pitch. For example, (4.3-6) a. [7]



It's absolutely certain.

L-M H-M L-M L

b.

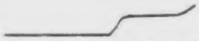


I simply can't imagine.

L H-M L-M L

It is also not difficult to find examples containing a succession of pitch rises; as for example,

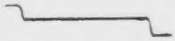
(4.3-7)



Are you going?

We have found similar examples in other languages; for example, the phrase below, from Tokyo Japanese, contains two pitch drops in a row:

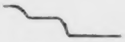
(4.3-8)



umi-de oyogi 'swimming in the sea'

and so does the following phrase from Igbo

(4.3-9)

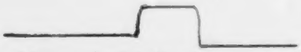


ụlọ Ekwe 'Ekwe's house'

Examples like these show that although it is generally true that pitch rises alternate with pitch falls within a phrase, it would be wrong to set up the theory in such a way as to exclude sequences of like pitch changes altogether. The dynamic-tone theory handles this situation in a straightforward way, by allowing the possibility of sequences of like tone markers within a phrase, but at the same time providing tonal processes such as rules of Like-Tone-Marker Deletion which serve to break up such sequences.

In this connection, it is important to recognize that rules of Like-Tone-Marker Deletion represent real tonal processes, and are not simply an artifact of the theory, as Liberman seems to suggest. Thus, it is a fact that when the Japanese words de\su 'it is' and ko/ko\ro 'heart' are combined to form the phrase ko/ko\ro desu 'It's a heart', the pitch drop of de\su is eliminated. Similarly, it is a fact that the second element of a compound in Mende has the tone shape ⌉⌊ except when it is immediately preceded by another ⌉⌊, as in *mbu\ hani* 'owl-thing' (contrasting with *mba/ha\ni* 'rice-thing'). The deletion of a pitch rise before a pitch rise is illustrated by the following example from Igbo, where the ↓ which comes at the end of *a↑khwa↓* in lexical representation is deleted before the $, with the result that the ↑ of *a↑khwa* is succeeded in the string by the ↑ of *A↑dha↓*, and so is deleted:

(4.3-10)



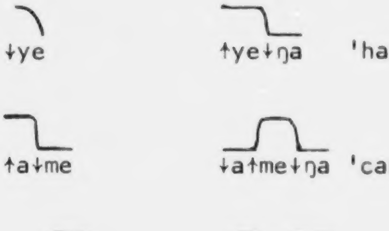
akhwa $ A↑dha↓zụtara↑ (from *a↑khwa↓* + *A↑dha↓* + *zụtara↑*)

'the eggs Adha bought' 'eggs' 'bought'

Any theory of tone must provide some mechanism to account for facts like these; it is an advantage of the dynamic-tone theory that it can account for them with independently-motivated rules of Like-Tone-Marker Deletion.

Similarly, "fill-in-the-contour" rules, which provide for a ↑ before a ↓ either in lexical representation or in the surface string, also represent a real linguistic phenomenon, for it is a fact that the basic tone contour of English, Japanese, Serbo-Croatian, Northern Tepehuan, and many other languages is LHL (= ...↑...↓...), with both a rise and a fall. A static-tone theory does not account for this fact automatically, any more than a dynamic-tone theory does; rather it suggests that languages might be expected to have the "simpler" basic tone shape, HL. Certainly without the notion of a tendency to place a ↑ before a ↓ and a ↓ before a ↑, it would be difficult to make sense of lexical tone contours like those shown below, from the Ogachogamitsu dialect of Japanese:

(4.3-11) a. Words with a ↓ before the final syllable[8]

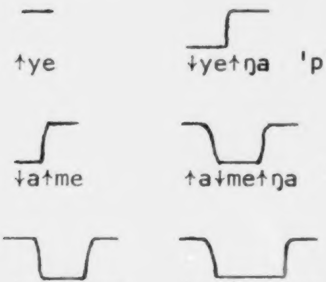


↓ye ↑ye↓ŋa 'handle' (+nominative marker)

↑a↓me ↓a↑me↓ŋa 'candy' (+nominative marker)

↓i↑na↓ga ↑i↓na↑ga↓ŋa 'country' (+nominative marker)

(4.3-11) b. Words with a ↑ before the final syllable[8]



↑ye ↓ye↑ŋa 'picture' (+nominative marker)

↓a↑me ↑a↓me↑ŋa 'rain' (+nominative marker)

↑o↓do↑go ↑o↓dogo↑ŋa 'man' (+nominative marker)

The lexical tone contours above can be defined by means of the lexical structure conditions below:

(4.3-12) a. Every word has the tone shape [...[+tone]σ]

b. In a word of the form $[\underset{1}{\ldots}\underset{2}{\sigma}\ \underset{3}{\downarrow}\ \underset{4}{\ldots}]$, 1 = ... ↑.

c. In a word of the form $[\underset{1}{\ldots}\underset{2}{\sigma}\ \underset{3}{\uparrow}\ \underset{4}{\ldots}]$,
1 = <↑σ>↓<...>, where ... contains no tone markers.

The first condition above establishes that the basic tone marker of a word of Ogachogamitsu comes just before the last syllable, and the second and third conditions tell how to fill in the tone contour of the rest of the word. Lexical tone contours like these are the result of a combination of two tendencies in human languages: (i) the tendency to insert a ↓ at the beginning of a tonal unit whose first internal tone marker is a ↑, and a ↑ at the beginning of a tonal unit whose first internal tone marker is a ↓, and (ii) a tendency to move a word-initial tone marker to the right. These two processes, repeated several times in the history of a language, would give rise to lexical tone contours like those of Ogachogamitsu. The development of lexical tone contours of this complexity is difficult to understand without the notion of a tendency to insert a ↑ before a ↓ and a ↓ before a ↑.

Before leaving the subject of rules which delete tone markers, I should say something about the sorts of environments in which we may expect tone markers to be deleted. The tone-deletion processes which we have encountered so far apply either in the environment of another tone marker or at the end of a phrase. While these are by far the most common environments for tone-deletion processes, tone markers are also deleted in other sorts of environments. For example, as I pointed out in section (3.3), there is a tone rule of Igbo which deletes a ↓ from a nominal phrase if that ↓ is preceded by a single syllabic segment and followed by two or more syllables within the phrase. (In addition, the tone marker which immediately succeeds the target ↓ must be a ↓.) This rule represents a rather different sort of deletion process from those we have seen so far. One possible phonological explanation for the existence of a rule of this sort is the fact, brought to my attention by Lehiste (1970), that in many languages the duration of the individual syllables of a word depends on the length of the word, with the syllables of longer words being significantly shorter than those of shorter words. If this were the case in Igbo, and if the tendency to shorten the syllables of a longer word were to extend also to the initial syllables of long phrases in general, then the deletion of a tone marker early in a nominal phrase with three or more syllables would have a phonetic basis, in that the early syllables of such a phrase would be too short to easily support a tone change. On the other hand, it may be a mistake to expect always to find a phonetic basis for phonological rules whose domain is specified in terms of labelled bracketing. Such rules, and in particular the rules we are considering here, are important indicators of syntactic structure, and this function also provides a basis for their existence within the grammar of a language.

5. Rules Which Fill in Phonetic Detail

I have found evidence for the following rules which create differences in size among ↓'s:

(5-1) ↓-Reduction (Igbo)

↓ → reduced in size / ___ ... ↓

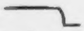
(5-2) End-of-Phrase Lowering (Kikuyu)

↓ → extra large / ___ P $, where P contains no ↓'s.

As I observed in the preceding section, languages commonly make use of fill-in-the-contour processes and rules of like-tone-marker deletion whose effect is to break up sequences of like tone markers within a phrase. I speculated that such rules exist in languages in order to make tone contours pronounceable, it being impossible to make many pitch rises or pitch drops in succession while still remaining within a comfortable pitch range for the speaking voice. However, while every language I have looked at has some processes which serve to break up sequences of like tone markers, these processes are often not strong enough to eliminate all sequences of ↓'s. (Sequences of ↑'s seem to be eliminated more efficiently.) Rules like the Igbo rule of ↓-Reduction (5-1), which makes all but the last of a sequence of ↓'s smaller in size than usual, soften the impact of a sequence of ↓'s which has been permitted to reach the surface form.

While I have specifically taken note of the process of ↓-Reduction only in Igbo, rules which determine the size of a pitch drop from the direction of the next succeeding tone marker in the string are common in languages. For example, there is a Streamlining process in Mende which converts the underlying forms below to the surface forms indicated:

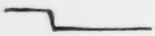
(5-3) a.



↑mbu↓ # ↑i ⟹ ↑mbu$\underline{\downarrow}$i

'owl' 'the' 'the owl'

b.



↑ke↓nya # ↑i ⟹ ↑ke$\underline{\downarrow}$nya # i

'uncle' 'the' 'the uncle'

The Streamlining rule which applies in these examples can be stated as follows:

(5-4) Streamlining (Mende)

[+tone] → 0 / ↓ (σ) (#) ___

Streamlining is optional when there is an intervening syllable between the controlling tone marker and the target tone marker, as in (5-3 b). However, what we are concerned with here is not the streamlining process itself, but rather the fact that the underlined pitch drops of (5-3) are smaller than usual. Since the rule of Like-Tone-Marker Deletion for Mende (4.3-2) will have deleted any ↑ to the right of ↑*i*, 'the', these underlined ↓'s must either be the last tone marker of the phrase, or must be succeeded by a ↓. Thus their reduced size can be accounted for by means of a rule similar to the rule of ↓ -Reduction for Igbo:

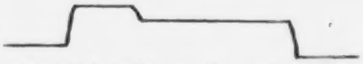
(5-5) ↓-Reduction (Mende)

↓ → reduced in size / ____ P (↓...) $

where P contains no tone markers

Similarly, in the English sentence

(5-6)

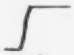


I'm ↑abso↓lutely cer↓tain

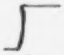
the first pitch drop of the contour is a "reduced" pitch drop. These examples suggest that the reduction of one pitch drop before another is a very common if not universal tonal process.

Another possible environmental influence on the size of a tone change is the nature of the consonants which adjoin it. Thus in Ewe, the rise in pitch between the prefix of a noun and a high-toned stem is greater when the stem begins with an obstruent than when it begins with a sonorant, as can be seen in the examples below:

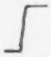
(5-7) a. Where the stem begins with an obstruent.



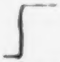
abla (proper name)



adzo (proper name)

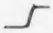


exa 'broom'

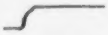


ekpe 'stone'

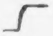
b. Where the stem begins with a sonorant.



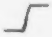
eyi 'cutlass'



anyigba 'floor'



ewɔ 'flour'



eŋɔ 'worm'

I am not yet certain how these facts should be analyzed in a dynamic-tone framework, but certainly one possibility is a rule adjusting the size of a pitch rise in the environment of certain kinds of consonants.

6. The Influence of Tone on Phonological Processes

In the preceding sections, we have seen that tonal processes may depend on certain features of the phonological string -- in particular, on syllabic structure, on the presence or absence of an initial consonantal portion in the syllable, on nasality, on voicing and obstruency, and on vowel height. Except for vowel height, features which designate the position of articulation of phonological segments apparently play no role in tonal processes. Nevertheless, rules which move or delete tones have access to a great deal of information about the segmental composition of the string.

It is much more difficult to find phonological rules which make reference to the tone contour. The only such rules I have been able to find are rules of stress and lengthening -- for example, the rule of Serbo-Croatian which stresses the syllable before the first internal tone marker of a word. There also appear to be rules in many languages which lengthen a syllable before a tone marker at the end of a word or phrase, thereby giving that syllable sufficient length to absorb the tone change.

Because I do not know of any instance in which the application of a phonological rule (one which affects phonological segments only) is BLOCKED by the presence of a tone marker in the string, I assume that phonological rules are blind to tone markers except where their structural descriptions specifically require the presence of a tone marker. In other words, no phonological rule will fail to apply simply because the string to which it is applying contains a tone marker where the structural description of the rule does not provide for one. The presence of a tone marker in the string is, however, significant for tone rules.

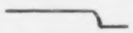
FOOTNOTES TO CHAPTER IV

[1] This list of rules which insert tone markers is limited to rules which are strictly phonological, that is, in which tone markers are introduced as tone markers. I have not included syntactic rules like the rule which introduces the associative morpheme in Igbo. Here the target element is a morpheme which happens to consist of a tone marker alone, but which might just as easily have had some other phonological shape.

[2] This data is taken from McCawley (1968).

[3] Notice that the non-sonorant mora [p] in this example is treated as a tone-bearing unit. Hyman and Shuh note a tendency to simplify examples like this to

(i)



↑a rəp↓ci

in which case the mora [p] has combined with its sister mora to form a single tone-bearing unit, as in Osaka Japanese.

[4] The rule for this process may be stated as follows:

$$\uparrow \ldots \ \#\#\downarrow \left[\begin{bmatrix}\langle +\text{voice}\rangle \\ \langle +\text{son}\rangle\end{bmatrix} \ V\right]_{\mu}$$

s.d. 1 2 3 4 5

s.c. Move 4 to the right of 5.

[5] See Halle and Stevens (1971) for a proposal to give voiced obstruents and low-toned vowels the same value for certain features, for which voiceless obstruents and high-toned vowels have the opposite value. Notice, however, that what is conditioned by the voiced obstruents of (3.2-14) is a drop in pitch rather than low tone, for the second syllable of these words is still high-toned even though it is lower in pitch than the high-toned syllable which precedes it.

[6] Again I have included only true phonological rules, and not, for example, the rule which deletes the "downstep" of Kikuyu in the environment between a noun and its complement.

[7] Tone contours like these can be accounted for in a dynamic-tone framework in the following way: First, we have noted before that the ↑ of the basic English intonation contour does not

necessarily come right before the main-stressed syllable, but sometimes is found before some stressed syllable to the left of the main-stressed syllable. Thus the rule of ↑insertion for English is more accurately stated as follows:

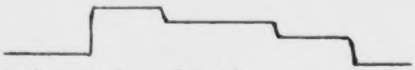
(iii) $$\emptyset \rightarrow \uparrow / \_\_\_ \left(\underset{[+\text{stress}]}{\sigma} \ \ldots \right) \ \underset{[1\text{stress}]}{\sigma}$$

In the intonation contours of (4.3-6), the parenthesized material in this rule has been chosen, so that the pitch rise comes rather early in the sentence. In such a case, it is possible to introduce one or more "extra" pitch drops between the ↑ and the ↓ of the contour. In other words, there is a rule

(iv) $$\emptyset \rightarrow \downarrow / \uparrow \ldots \_\_\_\_ \ \underset{[+\text{stress}]}{\sigma} \ \ldots \downarrow$$

Notice that this rule allows the insertion of as many pitch drops between the ↑ and the ↓ of the intonation contour as there are stressed syllables, and that seems to be correct. For example, it would be possible to introduce an additional ↓ before the syllable "cer" in (4.3-6 a), creating the tone contour

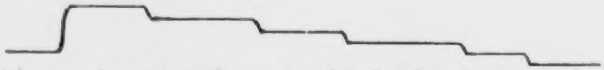
(v)



It's ↑abso↓lutely ↓ cer↓tain.

Even more ↓'s can be introduced if the string between the ↑ and the ↓ is longer, as in

(vi)



I'm ↑ abso↓lutely ↓ posi↓tively ↓ cer↓tain.

[8] This data is taken from Haraguchi (1975).

CHAPTER V

SOME MISCELLANEOUS ISSUES

1. Lexical Contrasts Involving Gliding Tones

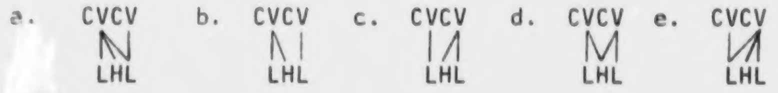
In the theory of tone which has been proposed here, a gliding tone on a single tone-bearing unit is accounted for by means of conventions which specify that a tone marker in a certain position is to be realized as a gliding tone on an adjacent tone-bearing unit rather than as a sharp change in pitch at the boundary at which it lies. While conventions for the realization of tone markers vary somewhat from language to language, the typical positions in which a tone marker is realized as a gliding tone on an adjacent tone-bearing unit are (i) at the beginning or end of a phrase, (ii) at the beginning or end of a word, or (iii) at the boundary of a long tone-bearing unit. A tone marker between two sufficiently sonorant segments will also be heard as a gliding tone, though not as a gliding tone on a single tone-bearing unit.

While conventions for the realization of tone markers may vary somewhat from one language to another, they may not, of course, vary from word to word within the same language. Thus lexical items with distinctively different tone contours must differ either in the nature of the tone contours themselves, or in the ways in which those contours are associated with the phonological string. In this respect, the dynamic-tone theory which has been proposed here agrees with all the other theories of tone with which I am familiar.

Where the dynamic-tone theory differs from other theories is in the number of different associations which it allows between a given tone contour and a given phonological string. For example, given a LHL tone contour (=...↑...↓...) and a phonological string containing two short syllables, the dynamic-tone theory which has been proposed here allows the three associations shown below between the tone contour and the phonological string:

(1-1) a. ↑CV↓CV b. CV↑CV↓ c. ↑CVCV↓

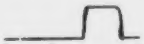
However, the autosegmental theory proposed by Goldsmith (1976) allows, in principle, the five different associations shown below:

(1-2)


Because of this difference in the number of ways in which a particular tone contour can be assigned to a phonological string of a given length, the autosegmental theory allows the expression of lexical tone contrasts which are not expressible in the dynamic-tone theory.[1] If lexical contrasts of this sort do not occur in human languages, and if no principled way can be found to exclude them within the autosegmental theory, then that is an argument for the dynamic-tone theory which has been proposed here. On the other hand, if lexical contrasts which cannot be expressed within the dynamic-tone theory do in fact occur, then the theory will have to be extended in such a way as to allow the expression of such contrasts.

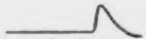
One possibly problematic language for the dynamic-tone theory which has been proposed here is the Takamatsu dialect of Japanese, which is one of the dialects analyzed by Haraguchi (1975). According to Haraguchi, who takes his data from Wada (1958), the Takamatsu dialect allows a falling glide on a short syllable within a word, and there is a contrast between such a falling tone and a HL sequence on successive syllables. For example, there is a contrast between the lexical items

(1-3) a.



kasiwamoti 'rice cake wrapped in oak leaf'

b.

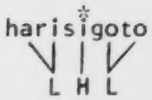


harisigoto 'needle work'

Haraguchi, following Wada, argues that words which have falling glides like that of *harisi/goto* at one time had their pitch drops one syllable earlier (so that *harisi/goto*, for example, was *hari/si\goto*); in fact, the older pronunciation is sometimes used even today. The modern pronunciation developed when the pitch drop moved one half mora to the right, creating a falling glide. This tone change took place just in case the mora on which the glide would occur either had an articulatorily low vowel, or was followed by a mora with an articulatorily high vowel.

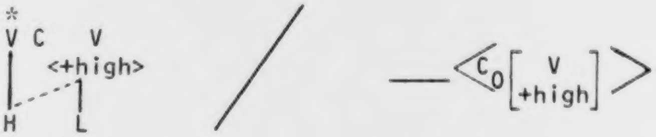
Haraguchi's analysis of the Takamatsu dialect follows this historical account very closely. Thus in his analysis, *harisi/goto* is derived from the underlying form *harisi*goto*. The basic tone melody, LHL, is mapped onto this underlying form in the manner shown below:

(1-4)



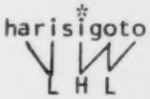
The surface tone melody is then obtained by applying the following two rules: First, there is a rule which associates the high tone of the tone melody with the following syllable if the vowel of that syllable is articulatorily [-high], or if it is followed by a [+high] vowel. The rule for this process is stated as follows,

(1-5)



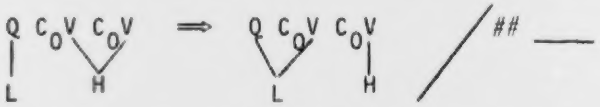
where the dotted line indicates the new tone-association which the rule creates. Rule (1-5) applies to the underlying form (1-4) to create the structure

(1-6)



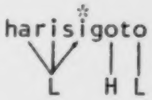
The second step in the derivation is the lowering of the starred mora. This change is accomplished by means of the rule

(1-7)

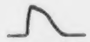
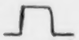


This rule dissociates the starred syllable of (1-6) from the high tone of the tone melody and re-associates it with the first low tone of the tone melody. The structural description of the rule will be met only where rule (1-5) has applied, for the tone association process associates the high tone of the tone melody with one mora only. Applying this rule to the underlying form (1-6), we obtain the correct surface output

(1-8)



There is no way to account for the data of (1-3) within the dynamic-tone theory which I have proposed here, for my assumptions (i) that the mora is the smallest possible tone-bearing unit, (ii) that a tone marker may not appear inside a tone-bearing unit, and (iii) that two tone markers may not appear at the same boundary prevent me from giving distinct tone representations to the two items *kasiwa⌈mo⌉ti* and *harisi⌈goto*. Furthermore, the existence of virtual minimal pairs like that below precludes the possibility of linking the difference in the realization of the pitch drop in the two cases to some difference in the phonological string:

(1-8) a.  tanuki 'badger' b.  azuki 'red beans'

It seems, then, that if the facts of Takamatsu have been reported correctly, it will be necessary to extend the theory in such a way as to allow a tone marker between the initial consonantal portion of a syllable and the syllabic nucleus in examples like (1-3 b) and (1-8 a).

I would not like to have to weaken the theory in this way, and perhaps it will not be necessary to do so; for the data presented here is sufficiently unmanageable within any theory of tone to cast doubt upon its accuracy. Certainly, Haraguchi's autosegmental analysis of these facts is theoretically suspect -- first, because it requires the very complicated rule (1-5), a tone rule whose application depends on detailed information about the phonological environment of the syllable to which it applies, and secondly, because it requires a special rule, (1-7) to insure that every syllable up the the syllable on which the drop takes place has low tone. This is the general pattern for words with the LHL tone melody, and one would hope to be able to account for its occurrence in *harisigoto* in the same way in which one accounts for its occurrence in words like *kasiwamoti*, namely, by means of the tone-association process.

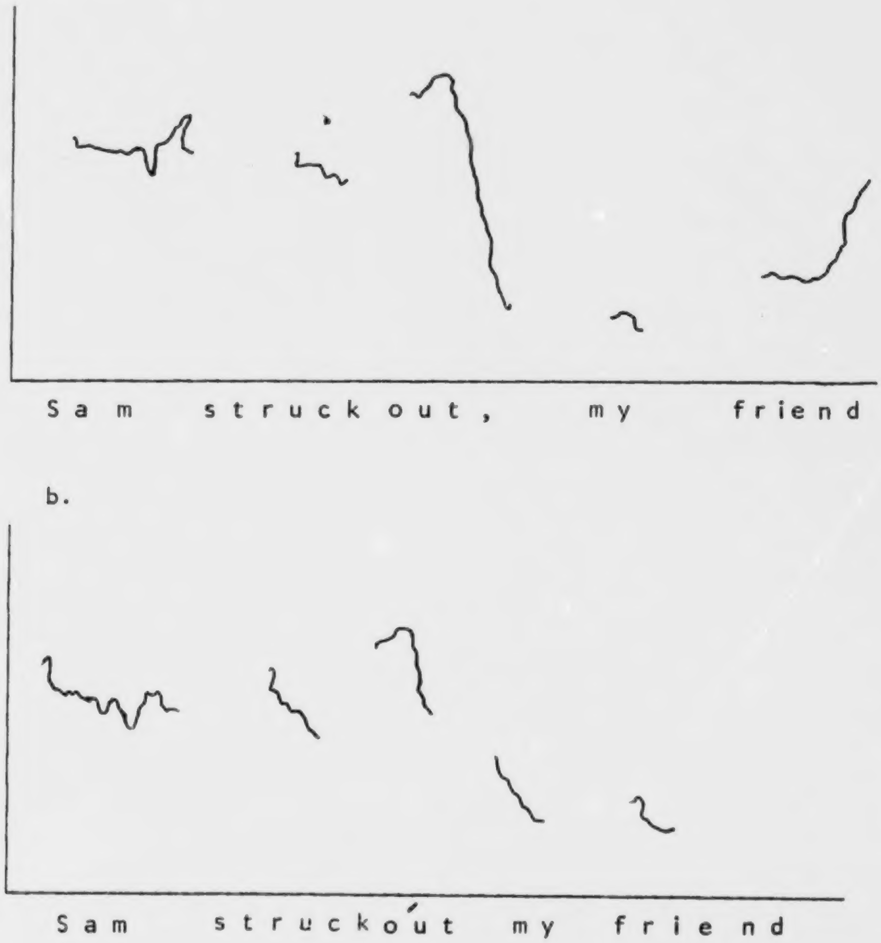
In addition to my doubts about the possibility of giving a plausible analysis of this data within any theory of tone, I also have doubts about the physical possibility of a distinctive gliding tone on a short syllable within a word. My skepticism about the possibility of such gliding tones arises from the contrast pointed out by Liberman (1975) between the two English sentences

(1-9) a. Sam struck oút, my friend.

b. Sam struck oút my friend.

These two sentences can be given the same stress pattern by assigning contrastive stress to the word *out* in (b). Even when their stress patterns are the same, however, their tone contours are not, as Liberman points out, for sentence (a) has the first tone contour shown below, and sentence (b) the second:

(1-10) a.



Ignoring the rise in pitch at the end of (a), which is not obligatory, and which is irrelevant to the point I want to make here, the difference between these two intonation contours is just that in the first case the drop in pitch between *out* and *my* is realized during the syllable *out*, as a falling glide on that syllable, while in (b) it is realized at the boundary between the two syllables -- partly on the first syllable and partly on the second and partly during the unvoiced interval between the two. But this difference in the realization of the pitch drop between *out* and *my* in these two cases is possible only if there is a pause between the two syllables; if the terminal pitch rise of (a) is eliminated, and if there is no pause after *out*, then (a) and (b) are indistiguishable, I find. In other words, it seems to be impossible to realize a pitch change as a gliding tone on the preceding short syllable, as in (a), unless that syllable is prolonged, as before a pause. This suggests that the contrast between the tone contours of *harisi∫go\to* and *kasiwa∫mo\ti* is possible only if the syllable *go* of *harisi∫g\oto* is a long syllable, and not a short syllable, as claimed.

If we assume that the syllable which carries the falling tone in words like *harisi∫goto* is a long, bi-moraic syllable, then a more satisfactory analysis of Takamatsu is available in either a dynamic-tone theory or an autosegmental theory, for *harisi∫goto* can then be represented as *harisig*$\overset{*}{o}$*oto* (*harisi↑go↓oto*) in contrast to *kasiwam*$\overset{*}{o}$*ti* (*kasiwa↑mo↓ti*), and the surface tone contour of each word will follow directly from its underlying representation.

Whatever the synchronic analysis of these tone contours in Takamatsu, the evidence is very strong that words like *harisi∫goto*, which have internal gliding tones in the present-day language, are derived historically from words like *hari∫si\goto* by the movement of a pitch drop to the right. Thus even if we agree that these words have been lexically re-analyzed in the way shown above, it is still necessary to explain how this re-analysis came about.

Without a great deal more information than I have available to me, it is impossible to make anything but the most tentative hypothesis. However, if I were to make a guess about how words like *hari↑si↓goto* came to be realized as *harisi↑go↓oto*, it would be the following: Words with lexical tone representations like *hari↑si↓goto* and *↑ta↓nuki* were subject to a rule which lengthened a short syllable following a pitch drop if that syllable either had an articulatory low vowel, or was followed by a syllable with a high vowel. This rule is stated below:

(1-11) $\downarrow [C_0 \underset{<+\text{high}>}{V}]_\sigma <C_0 \underset{[+\text{high}]}{V}>$

s.d. 1 2 3 4 5

s.c. 3 > doubled

Now suppose that the conventions for the realization of tone markers in Takamatsu were such that a ↓ before a long syllable was realized at least partly as a gliding tone on that syllable. In that case, it would be natural for speakers to re-analyze the ↓ as coming between the two moras of the following syllable. When that happened, the position of the ↑ of the tone contour would also have to be re-analyzed, in keeping with the lexical structure conditions of Takamatsu, which specify that in a word with an iternal ↑, that ↑ must be followed by a ↓ one mora later.

This reconstruction of the history of the Takamatsu dialect is, as I said before, only tentative; much more careful research will be needed before it can be definitely concluded that the facts of this language do or do not require a revision of the dynamic theory of tone.

2. The Distribution of Word-final Gliding Tones

According to Edmundson and Bendor-Samuel (1966), there are rising and falling tones at the ends of one and two syllable words in Etung, but only rarely at the ends of three-syllable words. This distribution of gliding tones can be accounted for in a very simple way in an autosegmental theory by defining the tone melodies of Etung as L, LH, HL, H, LHL, LLH, HHL, and HLH, and by assigning tone segments to the syllables of a word in a one-to-one fashion from left to right. Since there is no tone melody in Etung with more than three syllables, gliding tones can be obtained in this way only for words of one or two syllables. The lexical tone melodies of Etung are illustrated in the chart below (repeated from Chapter 1, section 7.1):

(2-1)

Tone pattern	1-syll word	2-syll word	3-syll word
a. L	kpè 'even'	ǹjòm 'juju'	èyǜrì 'dress'
b. LH	kǎ 'to'	ǹsí 'fish'	bìsóŋé 'spoon'
c. HL	tîk (future)	égòm 'jaundice'	ákpùgà 'money'
d. H	kpá 'first'	gbáń 'servant'	ŋ́kímí 'prosecutor'
e. LHL	--	òbô 'arm'	m̀bútà 'rain'
f. LLH	--	ǹsǐ 'mud'	òròbé 'beam'
g. HHL	--	éfô 'cloth'	ŋ́gárà 'pepper'
h. HLH	--	ábǒ 'they'	édìmbá 'pot'

In the dynamic-tone theory which has been proposed here, the gliding tones at the ends of some words in Etung must be regarded as the realization of tone markers which lie at the ends of these words in lexical representation. In this theory, then, the fact that there are no gliding tones at the ends of three-syllable words must be accounted for by means of a lexical structure condition which prohibits tone markers from occurring at the ends of three-syllable words in lexical representation. However, the theory itself does not predict that languages are likely to have lexical structure conditions of this sort -- instead it is necessary to find some "outside" explanation for the existence of such a condition in a language. It is not difficult to come up with potential explanations. For example, we might hypothesize that Etung at one time had no word-final tone markers at all, but that the final syllables of many words were eliminated through some historical process, bringing what were formerly word-internal tone markers into word-final position. In a language with a history of this sort, we would find word-final tone markers only in the shorter words which had undergone the truncation process, and not in the longer ones which had not.

In Mende, another language which has gliding tones at the ends of many short words, but not, as far as I know, at the ends of longer words, there may be a historical explanation of a different sort, for Leben (1973) reports a suggestion of D. Dwyer's that all monomorphemic three-syllable words in Mende are fairly recent borrowings -- perhaps from a language which either has no word-final tone markers, or which does not pronounce such tone markers as gliding tones. A third potential explanation is based on an observation by Lehiste (1970), that in some languages (Lehiste cites Hungarian as an example) "the word as a whole has a certain duration that tends to remain relatively constant" so that "the longer the word, the shorter the duration of the vowels". If Etung is a language of this sort, then the absence of gliding tones at the ends of three-syllable words may have a simple phonetic explanation -- that a syllable of a word of this length is not long enough to carry a distinctive gliding tone. In the absence of detailed information about the history and sound system of the language, it is impossible to know which, if any, of these three explanations of the distribution of gliding tones in Etung is correct.

Before leaving this subject, I would like to point out that the explanation which Edmundson and Bendor-Samuel give for the non-occurrence of gliding tones at the ends of multi-syllabic words in Etung depends on the assumption that languages may make use of tone melodies such as LLH, which contain a sequence of identical tone segments. Leben (1977) argues for an Obligatory Contour Principle which excludes such contours in principle. In Leben's version of the theory nouns like *òròbé* 'beam' in Etung would have to be analyzed as having the LH tone melody, with the high tone specifically assigned to the final syllable of the word, as in a pitch-accent language. In this version of the autosegmental theory, the absence of gliding tones at the ends of multi-syllabic words in Etung no longer results automatically from the principles of tone-association, but would have to be accounted for independently, as in the dynamic-tone theory.

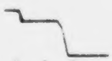
3. Tonal Stability

Another sort of phenomenon which has been used to argue for an autosegmental theory of tone is the phenomenon which Goldsmith (1976) has called "stability", by which he means that

> In tone languages we find that when a vowel desyllabifies or is deleted by some phonological rule, the tone it was bearing does not disappear -- rather, it shifts its location and shows up on some other vowel ... thus the tone melody preserves itself despite modifications to the syllabic structure.

A simple instance of tonal stability can be seen in the following example from Igbo, which, like many African languages, has a rule assimilating the first of two contiguous vowels to the second. Consequently, when we combine the words *ị↓sa↓* 'to wash' and *ite↑* 'pot', we get

(3-1)



isi ite 'to wash pots'

The point of this example is that the rule which assimilates the *a* of *ị↓sa↓* to the *i* of *ite↑* gives *a* all the phonological features of *i*, but not its low tone.[2] The fact that assimilation processes do not ordinarily affect tone is difficult to account for if tone is specified by means of features on sonorant segments. However, the independence of tone from phonological processes is predicted by both the autosegmental theory and the dynamic-tone theory, for in both these theories tone is specified by units which are distinct from phonological segments, and so the processes which affect the phonological segments would not be expected to affect them. The derivation of the phrase of (3-1) in these two theories is given below:

(3-2) a. ị↓sa↓ite↑ ⟹ ị↓si↓ite↑

```
      b.  ịsa ite  ⇒ ịsi ite
          | | | |    | | | |
          H D L L    H D L L
```

More complex examples of tonal stability arise when syllables which are expected to carry a part of the tone contour lose their tone-bearing capacity through some phonological process such as the devoicing, de-syllabification, or deletion of a vowel. For example, in Japanese there is a rule which de-voices an articulatory high vowel when it comes between two voiceless consonants. Having lost its voicing, the vowel is no longer capable of bearing tone, and the tone contour is shifted in certain predictable ways, as can be seen from the following facts described by Haraguchi (1975).

Recall that in standard Japanese, most words have an "accent", which consists of a fall in pitch. While the position of the accent in nouns is idiosyncratic, the position of the accent in adjectives of the accented class is predicted by the following lexical structure condition:

(3-3) a. Dynamic-tone version: An adjective stem of the accented class has the lexical tone shape [...↓σ].

b. Autosegmental version: An adjective stem of the accented class takes the form $[\ldots C_o \overset{|}{V}\ ([+son])\sigma]$.

The position of the accent is maintained when the adjective stem combines with various suffixes, as in the examples

(3-4)

Stem	Pre-verbal form	Past form
si↓rok- 'white'	si\roku	si\rokatta
tano↓sik- 'happy'	ta/no\siku	ta/no\sikatta

While adjectives of the accented class are accented in all forms, adjectives of the unaccented class do not have accents unless they are combined with "pre-accenting" elements such as *↓katta*. Thus we find, for example,

(3-5)

Stem	Pre-verbal form	Past form
akak- 'red'	a/kaku	a/ka\katta

Haraguchi uses the rule

(3-6) $V \rightarrow * \ / \ \_\_\_\_\ \text{katta}]_{ADJ}$

to account for the pitch drop in *a/ka\katta*; in a dynamic-tone system we can account for this pitch drop simply by assuming the lexical representation *↓katta* for the past tense suffix.

Following the pattern described above, we expect that the accented adjective *tikaku* 'near' (= *tikak-* + *-u*) will be pronounced as **ti\\kaku*, and that the adjectives *atukatta* and *yasasikatta*, which have unaccented stems, will be pronounced **a/tu\\katta* and **ya/sasi\\katta*. However, in these adjectives, the syllable which would normally be followed by the pitch drop is de-voiced, by the devoicing rule mentioned above, and the pitch drop is shifted to a position following an adjacent syllable of the word, producing the surface forms

(3-7) t$\underset{\circ}{i}$ka\\ku a/t$\underset{\circ}{u}$ka\\tta ya/sa\\s$\underset{\circ}{i}$katta

Adjectives like these pose two problems for the theory of tone: first, the theory must predict that the devoicing of the syllable which precedes the ↓ of the tone contour will cause that ↓ to be realized in some other position in the word. Secondly, the theory should predict WHERE the pitch drop will be realized.

Haraguchi argues that the autosegmental theory meets both criteria. In particular, Haraguchi argues that the shifting of the pitch drop in cases like these is brought about by an "erasure" convention, which erases the association between a phonological segment and a tone segment when the phonological segment loses its capacity to carry tone. The tone segment is then re-associated with an adjacent, still tonally viable segment. I will outline Haraguchi's analysis below, and then show how these facts can be accounted for in a dynamic-tone theory.

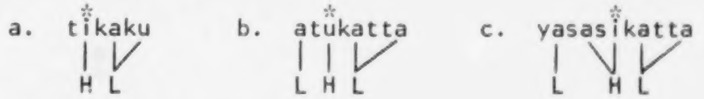
In Haraguchi's analysis, the adjectives of (3-7) are assigned starred syllables as follows

(3-8) t$\overset{*}{i}$kaku (by (3-3 b))

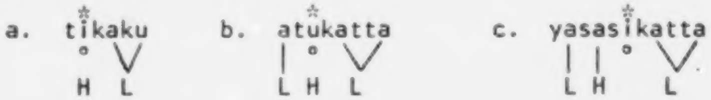
at$\overset{*}{u}$katta (by (3-6))

yasas$\overset{*}{i}$katta (by (3-6))

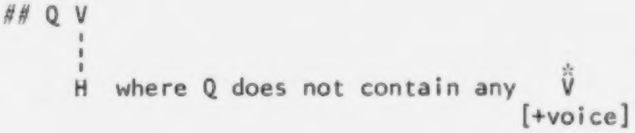
The association of the HL tone melody, and the application of Initial Lowering then create the following tone representations:

(3-9)


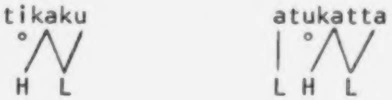
It is at this point that the rule of vowel de-voicing applies, de-voicing the vowel of the starred syllable in each of these examples, a change which automatically results in the dissolution of the association between that syllable and its tone segment. Thus we now have the representations

(3-10)


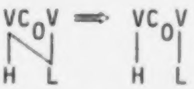
The erasure of the association between the voiceless syllable and its tone segment is sufficient by itself to produce a well-formed output for *ya sa sikatta*, since the high tone segment in this form is already associated with an adjacent, voiced syllable;[3] however, (3-10 a) and (3-10 b) are not well-formed as they stand, for they violate the universal well-formedness condition that every tone segment must be associated with a sonorant segment. Thus the high tone in these examples must be re-associated, and, because of the condition that association lines may not cross, it must be re-associated with an adjacent sonorant segment. There is only one such segment in (3-10 a), but in (3-10b) there are two, and some principled way must be found to choose between them. Haraguchi suggests that the choice is made in such a case by a re-appeal to the Tone Association Rule, repeated below:

(3-11)


Because this rule associates the high tone of the tone melody as far to the right as possible, the high tone segment of (3-10 b) is also associated to the right, giving the following tone representations for (3-10 a) and (3-10 b):

(3-12)


The Contour Simplification Rule,

(3-13)


then eliminates the contour tone which is created by the re-association of the high tone.

It is true, as Haraguchi claims, that this is a more principled account that could be obtained for these facts in a segmental theory, for a theory in which tone is specified by means of features on sonorant segments would not even predict the PRESERVATION of a tone specification when the phonological segment with which it is associated loses its tone-bearing quality. However, Haraguchi's account of the surface position of the high tone segment of *a/tu̥ka\tta* is not as principled as one might like, because it depends on a re-appeal to the Tone Association Rule (something would have to be said, at least, about the circumstances under which one may re-appeal to a previously-applied rule of the grammar) and because the effect of the rule in this particular case depends on exactly how it is stated. Thus, if the high tone had been found to associate to the LEFT, then that fact, also, could have been accounted for by a re-appeal to the Tone Association Rule, which would then be stated as follows:

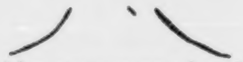
$$(3\text{-}14)\quad \#\#\, Q \underset{\substack{[+\text{voice}] \\ \vdots \\ H}}{V}, \text{ where } Q \text{ contains no } \overset{*}{V}.$$

The Contour Simplification Rule (3-13) is also added just to account for this particular case, and is not independently motivated.

I believe we can give a better account of these facts within a dynamic-tone theory. Specifically, what I propose is this: Suppose that the de-voicing of a syllable destroys its status as a tone-bearing unit, and that it is consequently incorporated into an adjacent tone-bearing unit. Individual languages may differ as to which adjacent syllable a de-syllabified syllable is incorporated into, but in Tokyo Japanese, it is apparently incorporated into the succeeding syllable. Otherwise, it would be difficult to make sense of Haraguchi's intuition that the correct tone contour is *ya/sa\si̥katta* rather than *ya/sasi̥\katta*, for *si̥* is in fact toneless. If this notion that the voiceless syllable comes to act as a tonal unit with the following syllable is correct, then that explains why the shift in the position of the tone-marker must take place, for a tone marker may not appear inside a tone-bearing unit. Thus, when *yasasi* combines with *↓katta*, and the final syllable of *yasasi* is devoiced and merged into a single tonal unit with the first syllable of *↓katta*, the resulting string is ill-formed, for the ↓ of *↓katta* now lies inside a tone-bearing unit. This ill-formedness in the string can be corrected by moving the tone-marker either over the voiceless syllable to the beginning of the tone-bearing unit, or over the voiced syllable to the end of the tone-bearing unit. Presumably the former choice is the one which creates least disturbance in the tonal structure of the string; in any case this is the direction in which the embedded tone marker is moved in Tokyo Japanese, so that the underlying *yasasi↓katta* becomes *yasa↓si̥katta*.

The same account may be given of a similar phenomenon in English. For example, observe the tone-shape of the Enlgish sentence

(3-15)



I'm not su̥rprised

(taken from an F_0-contour given by Liberman (1975)). The fact that the rise in pitch in this phrase comes at the end of the syllable *not* rather than after the de-voiced syllable *su̥r* can be accounted for in the same way as the position of the rise in pitch in the Japanese word *ya/sa\si̥katta*. The de-voiced syllable is incorporated into the syllable which follows it, and the pitch-change which would ordinarily come after it is moved in front of it, in compliance with the well-formedness condition on output strings which confines tone-markers to the boundaries of tone-bearing units.

While the position of the pitch rise of the English sentence (3-15) and of the pitch fall in the Japanese adjective *ya/sa\si̥katta* can be accounted for by means of the general principle that a tone-marker which is embedded in a tone-bearing unit moves to the boundary which lies in the opposite direction from the nucleus of the tone-bearing unit, this principle does not account for the position of the pitch drop in *ti̥ka\ku* and *a/tu̥kat\ta* (3-7). In these examples, the pitch drop is found not at the beginning but at the end of the tone-bearing unit which is formed by the merger of the de-voiced syllable with the syllable which follows it. However, it is easy to see why the pitch drop moves to the end of the syllable rather than to its beginning in these cases. It is because the pitch rise which is inserted by the rule of ↑-insertion, repeated below,

(3-16) $\emptyset \rightarrow \uparrow$ / \$ ([C_0V]) _____

comes right before the voiceless syllable in each of these words.[4] Consequently, if the ↓ of these words were moved to the beginning of the voiceless syllable, that would constitute a violation of the second well-formedness condition, which states that any two tone markers must be separated by a tone-bearing unit.

I do not know whether the re-adjustments in the tone contour of Japanese in response to a loss of syllabicity take place according to universally-binding principles, or whether one might find differences among languages in the way they correct an ill-formedness in the tone representation which arises in this way. For example, it may be simpler to move a "trapped" tone marker to the boundary which lies in the opposite direction from the nucleus of the tone-bearing unit, but there is no guarantee that every language will choose the simple way of doing things. One can imagine a language which simply deleted a trapped tone marker,[5] or which moved such a tone marker to the nearest syllable boundary even if that boundary was already occupied by a tone marker. Nevertheless, the account which I have given here works well for Japanese, and for examples like *I'm not surprised* in English. In addition, it accounts for some facts of Margi, a language of Nigeria, which were discussed by Williams (1976).

According to Williams, there are processes of glide-formation and vowel-deletion in Margi which bring about the de-syllabification or deletion of a vowel at the end of the verb stem, with the tonal consequences shown below:

(3-17) a. kùtù + iá ⇒ kùtyá 'look at'

b. ndèbè + iá ⇒ ndèbyá 'beat'

c. fǐ + ani ⇒ fyàní 'to make swell'

d. tlà + wá ⇒ tlwǎ 'to cut in two'

e. ngìr + rí ⇒ ngyǐr 'to light'

Notice that when the verb stem is bi-syllabic, as in (a) and (b), the tone of the de-syllabified syllable is lost, but when the verb stem is monosyllabic, as in (c), (d), and (e), the tone of the stem is retained in the surface form.

Williams' explanation of these facts is based on the assumption that a bi-syllabic low-toned stem has a single tone specification which is mapped onto both its syllables. If we assume, furthermore, that the tone contour of a complex item is obtained by adding together the tone contours of its parts, then the facts above follow automatically. Thus, *kùtù* has the tone melody L and *iá* has the tone melody H, and *kùtyá* (=*kùtù* + *iá*) has the tone melody LH distributed evenly over its two syllables. Similarly, *fǐ* has the tone melody LH and *ani* is toneless, so that *fyàní* has the tone melody LH, again distributed evenly over its two syllables. Finally, the tone melody of *tlà* is L and that of *wá* is H, so that the tone melody of *tlwǎ* is LH, which is, of necessity, mapped onto a single syllable, creating a rising tone.

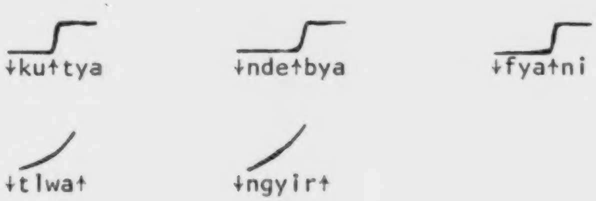
We can also give a satisfactory account of these facts within the dynamic-tone theory, in the following way: Let us assume that the lexical tone system of Margi is like that of Mende, so that the individual morphemes of (3-17) have the lexical tone specifications given below:

(3-18)
↓kutu
↓ndebe
↓fi↑
↓tla
↓ngir

↑ia
ani
↑wa
↑ri

Similarly, the complex verbs of (3-17) have the lexical tone specifications

(3-19)


↓ku↑tya
↓nde↑bya
↓fya↑ni
↓tlwa↑
↓ngyir↑

As in Mende, a tone-marker at the end of a word is pronounced as a gliding tone on the preceding syllable, and a tone-marker at the beginning of a phrase is not pronounced.

The tone specifications of (3-19) are derived from the tone specifications of (3-18) in the following way:

(3-20)
a. ↓kutu + ↑ia ⟹ ↓kut$\underline{\uparrow}$ya ⟹ ↓ku$\underline{\uparrow}$tya
b. ↓ndebe + ↑ia ⟹ ↓ndeb↑ya ⟹ ↓nde$\underline{\uparrow}$bya
c. ↓fi↑ + ani ⟹ ↓fy$\underline{\uparrow}$ani ⟹ ↓fya$\underline{\uparrow}$ni
d. ↓tla + ↑wa ⟹ ↓tl$\underline{\uparrow}$wa ⟹ ↓tlwa$\underline{\uparrow}$
e. ↓ngir + ↑ri ⟹ ↓ngi$\underline{\uparrow}$r ⟹ ↓ngir$\underline{\uparrow}$

The re-adjustment in the position of the underlined tone-markers in the examples above takes place according to the same principles which we have observed in Japanese: A tone-marker which is embedded in the initial consonantal portion of a syllable is moved to the beginning of the syllable unless there is already a tone-marker in that position, in which case the tone-marker is moved to the end of the syllable. Thus in (a) and (b), where there is no tone-marker at the beginning of the syllable which contains the underlined tone-marker, that tone-marker moves to the beginning of the syllable, but in (c) and (d), where there is already a tone-marker at the beginning of the syllable, the underlined tone-marker moves to the end of the syllable. In (e), where the underlined tone-marker lies to the right of the syllabic nucleus, it is, of course, moved to the end of the syllable.

FOOTNOTES TO CHAPTER V

[1] This difference between the two theories was discussed previously in Chapter 1, section 4.

[2] Welmers (1968) claims that the assimilation in this environment is not complete so that, for example *i↓sa↓ite↑* 'to wash pots' is, even after the assimilation, distinguishable from *i↓si↓ite↑* 'to cook a meal' (literally, 'to cook pots').

[3] However, notice that Haraguchi's representation does not distinguish between the tone contours *ya/sa\si̥katta* and *ya/sasi̥\katta*, though he seems to suggest that there is a distinction between the two, and that the former is the correct tone contour for this word.

[4] I am assuming here that the ↑ is inserted while the ↓ of *ti̥ka\ku* is still in its underlying position before the final syllable of the stem. An alternative, and perhaps more plausible, explanation for the rightward movement of the ↓ in this case is that if it were to move to the left, over the voiceless syllable *ti̥*, it would end up at the beginning of the word, in violation of the general condition in Tokyo Japanese that no member of a lexical category may begin with a ↓ in lexical representation.

[5] This alternative is apparently taken in Igbo in connection with the preposition *na↑*, which loses its vowel and its ↑ before a vowel. Thus we find the contrasting examples

(i) a.

na↑ La↓gos↑	(*na↑* + *La↓gos↑*)	
'in Lagos'	'in'	name of a city

b.

nenu↓gwu↓	(*na↑* + *Enu↓gwu↓*)	
'in Enugu'	'in'	name of a city

If the vowel alone were deleted in (b), the resulting output would be the ill-formed **n↑enu↓gwu↓*, with a ↑ trapped inside a syllable. In this case, the creation of an ill-formed output is avoided not by moving the ↑ to the nearest syllable boundary, but by deleting it altogether.

CHAPTER VI

THE TONAL PROPERTIES OF NOUN PHRASES IN IGBO

1. Introduction

In Chapter II, I argued that a possessive phrase and the constituent which it modifies in Igbo are separated by an "associative" morpheme which consists of a drop in pitch only. The grammatical pitch drop which marks a phrase of this kind can be seen between the two words of the phrase below:

(1-1)

isi ↓ Ekwe ↓ (from *isi↓* + ↓ + *Ekwe↓*)

'Ekwe's head' 'head'

This associative pitch drop causes the deletion of lexical tone markers to either side of it, by the rules of Right and Left Streamlining, which are repeated below:

(1-2) a. Right Streamlining

↓ (#) ([+syll]) [+tone]

s.d. 1 2 3 4

s.c. Delete 4.

b. Left Streamlining

σ [+tone] (#) (#) ↓

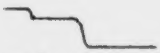
s.d. 1 2 3 4 5

s.c. Delete 2.

Condition: If 3 and 4 are both present, then 1 is not long.

The effects of Right and Left Streamlining can be seen in the phrase below, where the ↑ at the end of *ụ↓lọ↑* and the ↓ after the first syllable of *O↓gu↑* have been deleted in the environment of the associative ↓:

(1-3)



ụ↓lọ ↓ Ogu↑ (from *ụ↓lọ↑* + ↓ + *O↓gu↑*)

The unequal size of the two pitch drops in the phrase above is the result of a rule of ↓-Reduction, which reduces the size of all but the last of a sequence of ↓'s. The rule of ↓-Reduction is repeated below:

(1-4) ↓-Reduction

↓ ... ↓ ... $$[1]

s.d. 1 2 3 4 5

s.c. Reduce the magnitude of 1 by two-thirds.

This rule reduces the size of the first ↓ in the phrase above. The second ↓ is not affected, because the tone marker which follows it in the phrase is a ↑.

In example (1-3) above, the ↑ at the end of the head noun is deleted by the rule of Streamlining. If there had been no tone marker before the final syllable of the head noun, a different rule, the rule of ↑-Retraction, would have applied. This rule is repeated below:

(1-5) ↑-Retraction

σ σ ↑ (#) (#) ↓

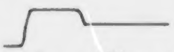
s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

Condition: If 4 and 5 are both present, then 2 is not long.

The effects of ↑-Retraction can be seen in the example below, in which the ↑ at the end of *ala↑* has been retracted one syllable before the associative ↓:

(1-6)



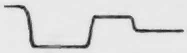
a↑la ↓ Ekwe↓ (from *ala↑* + ↓ + *Ekwe↓*)

'Ekwe's land' 'land'

In summary, examples (1-1), (1-3), and (1-6) show (i) that there is an "extra" pitch drop between the two constituents of a proper noun possessive construction, and (ii) that that pitch drop causes the deletion or retraction of nearby pitch markers to either side of it.

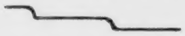
The reader will probably recall that the associative pitch drop appears also in common noun possessives, but that its position and effect in this construction are different in some ways from its position and effect in the proper noun possessive. In particular, in the common noun possessive, but not in the proper noun possessive, the associative ↓ moves to the right of the first syllable of the possessive noun phrases if that first syllable is either (i) a high-toned syllabic segment, or (ii) a syllabic nasal which is followed by a nasal consonant. Two examples are given below:

(1-7) a. Showing that the associative ↓ moves to the right of a high-toned syllabic segment:



ụ↓lọ ↑ e↓γu↓ (from *ụ↓lọ↑* + ↓ + *eγu↓*)[2]

b. Showing that the associative ↓ moves to the right of a low-toned syllabic nasal which is followed by a nasal consonant:



ụ↓lọ m↓mayัa↓ (from *ụ↓lọ↑* + ↓ + *m↑maỹa↓*)

'bar' 'house' 'wine'

Given the assumption that the associative ↓ has cliticized to the possessive noun phrase in this construction, we may account for its position in the surface form by means of the rules below:

(1-8) a. ↓-Metathesis.

$_{NP}$[↓ [+syll] ...↓...]

s.d. 1 2 3 4 5

s.c. Transpose 1 and 2.

b. Syllabic-nasal Raising.

$\#\#\ [+\text{tone}] \begin{bmatrix} +\text{syll} \\ +\text{nas} \end{bmatrix} [+\text{nas}]$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

The first of these rules moves the associative ↓ to the right of a high-toned syllabic segment, and the second moves it to the right of a syllabic nasal which is followed by a nasal consonant. (The ↑ which appears after the syllabic nasal in the underlying form will have been deleted by the rule of Streamlining by the time this rule applies.) In addition to the differences between the common and proper noun possessive which are illustrated above, there are also some differences in the applicability of the rules of Streamlining and ↑-Retraction in the two constructions, and a difference in the realization of the associative ↓ when the second element of the construction begins with a consonant. The reader is referred to Chapter II, section 3.4, for a description and analysis of these additional differences between the common and proper noun possessive constructions.

In analyzing the common and proper noun possessive constructions in Igbo, I have assumed the presence of an associative morpheme between the two elements of the construction, but have not provided a rule for its insertion into the string; nor have I proposed a rule for the cliticization of the associative marker to the second element of the construction in the common noun possessive. The major part of this chapter will be devoted to the task of developing rules for these syntactic processes, which underlie many of the tonal phenomena of Igbo.

I will begin this chapter with a survey of the Igbo noun phrase, noting as I go along that the associative ↓ appears in a great many other positions in the noun phrase besides at the boundary between a possessive NP and the noun which it modifies. I will then show that a simple and elegant account of the syntactic distribution of the associative ↓ is possible if we assume a binary structure for all nominal categories in Igbo, and if we make use of the notion of natural classes of syntactic categories which is available in Chomsky's $\overline{X}$-theory. The distribution of the associative ↓ in Igbo will be shown to be strikingly similar to that of certain grammatical morphemes in Persian and Tagalog.

Finally, I will account for certain cases which are exceptions to the very general rules proposed earlier in the chapter. In particular, in section 5, I will account for the "pseudo" associative pitch drop which appears before a possessive pronoun of postnominal cardinal numeral under certain circumstances. The last section of the chapter introduces three ↓-deletion rules which account for certain cases in which the associative pitch drop fails to appear as expected.

2. The Structure of a Noun Phrase in Igbo

2.1 The simple NP. The word order of a simple noun phrase in Igbo is defined by the following phrase structure rule (Note, however, that this rule gives the noun phrase a flat, multi-limbed structure which I will argue against below):

$$(2.1\text{-}1) \qquad NP \rightarrow (NUM)(ADJ^*)\overline{N}(ADJ^*)(NUM)(NP_{POSS})\left(\begin{Bmatrix} DEM \\ NUM_{ORD} \end{Bmatrix}\right)$$

The rule above states that the head noun of a noun phrase in Igbo may be preceded by a numeral and one or more adjectives, in that order, and may be followed by one or more adjectives, a numeral, a possessive, and a demonstrative or ordinal numeral.

Whether a given numeral or adjective precedes or follows the head noun is a property of the lexical item. All numerals are postnominal, except for the four below, which are prenominal:

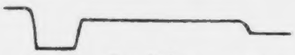
(2.1-2)	o↓tu↑	'one'	ọ↓gụ↓/ohu↓	'twenty'
	ih̃u↓	'forty'	n↓nu↑	'four hundred'

Conversely, all adjectives are prenominal except for the eight listed below, which are postnominal:

(2.1-3)	ọma↓	'good'	ukwu↓	'large'
	ọjọ↓ọ↓	'bad'	n↓ta↑	'small'
	oji↓i↓	'black'	ọhụ↓rụ↓	'new'
	ọca↓	'white'	o↓cye↑	'old'

The relative ordering of elements within the noun phrase is illustrated by the phrases below:

(2.1-4) Showing that a prenominal numeral precedes a prenominal adjective:

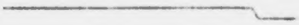


o↓tu↑ obodobo u↓te↓ 'one wide mat'

(from *o↓tu↑* + ↓ + *obodobo↓* + ↓ + *ute↓*)[3]
'one' 'wide' 'mat'

(**obodobo otu ute*)

(2.1-5) Showing that there may be more than one prenominal adjective:

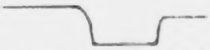


ogologo obodobo u↓te↓ 'a long, wide mat'

(from *ogologo↓* + ↓ + *obodobo↓* + ↓ + *ute↓*)

'long' 'wide' 'mat'

(2.1-6) Showing that a postnominal adjective precedes a postnominal numeral:



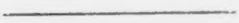
oce n↓ta a↑tọ↓ 'three small chairs'

(from *oce↓* + *n↓ta↑* + *a↑tọ↓*)

'chairs''small' 'three'

(**oce atọ nta*)

(2.1-7) Showing that there may be more than one postnominal adjective:

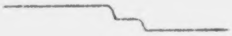


akwụkwọ ọca ukwu↓ 'a large white paper'

(from *akwụkwọ↓* + *ọca↓* + *ukwu↓*)

'paper' 'white''large'

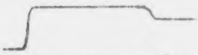
(2.1-8) Showing that a possessive noun phrase follows a postnominal adjective or numeral:

a. 

aỹa oji↓i↓ Ekwe↓ 'Ekwe's black eyes'

(from *aya↓* + *oji↓i↓* + ↓ + *Ekwe↓*)

'eyes' 'black'

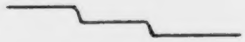
b. 

a↑hụ ọma e↓le↓ 'the beautiful body of a deer'

(from *a↑hụ↓* + *ọma↓* + ↓ + *ele↓*)

'body''beautiful' 'deer'

(2.1-8) c.



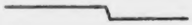
eγu ↓ atọ↓ Ekwe↓ 'Ekwe's three goats'

(from *eγu↓* + *a↑tọ↓* + ↓ + *Ekwe↓*)[4]

'goat' 'three'

(2.1-9) Showing that a possessive noun phrase may have internal structure:

a.

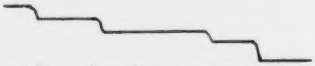


isi eγu↓ Ekwe↓ 'the head of Ekwe's goat'

(from *isi↓* + ↓ + *eγu↓ Ekwe↓*)

'head' 'Ekwe's goat'

b.

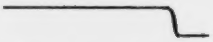


ụ↓lọ n↓nukwu m↓ma↓dhụ↑ 'the house of an important man'

(from *ụ↓lọ↑* + ↓ + *n↑nukwu m↓ma↓dhụ↑*)

'house' 'an important man'

c.



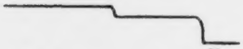
elu oce ukwu↓a↑ 'the top of this large chair'

(from *elu↓* + ↓ + *oce ukwu↓a↑*)

'top' 'this large chair'

(2.1-10) Showing that a possessive NP may be followed by a demonstrative or ordinal numeral.[5]

a.

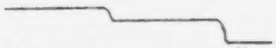


akwụkwọ↓ gị a↓h̃ụ↑ 'that book of yours'

(from *akwụkwọ↓* + *gị↓* + *a↓h̃ụ↑*)[6]

'book' 'your' 'that'

(2.1-10) b.

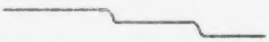


akwụkwọ↓ Ekwe a↓h̃ụ↑ 'that book of Ekwe's'

(from *akwụkwọ↓* + ↓ + *Ekwe↓* + *a↓h̃ụ↑*)

'book' 'that'

c.



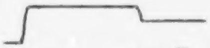
akwụkwọ↓ Ekwe↓ atọ↓ 'Ekwe's third book'

(from *akwụkwọ↓* + ↓ + *Ekwe↓* + ↓ + *a↑tọ↓*)

'book' 'third'

2.2 Nouns which take complements. The NP formula of (2.1-1) provides for a N̄-phrase in head position rather than simply a noun, in order to allow for certain verbal nouns which take complements, as in the examples below:

(2.2-1) a.

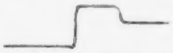


ọ↑ŋụŋụ m↓maỹa↓ 'the drinking of wine'

(from *ọ↑ŋụŋụ↓* + ↓ + *m↑maỹa↓*)

'drinking' 'wine'

b.



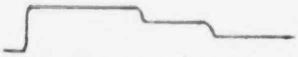
ọzịza↑ a↓ma↓ 'sweeping the path'

(from *ọzịza↑* + ↓ + *ama↓*)

'sweeping' 'path'

A N̄-phrase of this sort may be modified by a possessive phrase, as shown below. As in English, the possessive is given a "subject" interpretation:

(2.2-2)



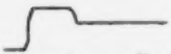
ọ↑ŋụŋụ m↓maỹa↓ Ekwe↓ 'Ekwe's drinking'

(from *ọ↑ŋụŋụ m↓maỹa↓* + ↓ + *Ekwe↓*)

'wine-drinking'

Another sort of noun which takes a complement is the agentive noun, which can be seen in the examples below:

(2.2-3) a.

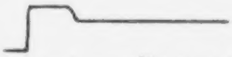


ọ↑ŋụ↓ mmaỹa↓ 'a wine-drinker'

(from *ọ↑ŋụ↓* + ↓ + *m↑maỹa↓*)

'drinker' 'wine'

b.



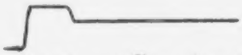
ọ↑ŋụ↓ mmaỹa ọma↓ 'a drinker of good wine'

(*ọma↓* 'good')

The second example shows that the "object" noun phrase may have internal structure.

An agentive-noun-plus-object may be modified by an adjective or demonstrative, as in

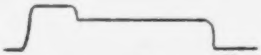
(2.2-4) a.



ọ↑ŋụ↓ mmaỹa ukwu↓ 'a great wine-drinker'

(*ukwu↓* 'large, great')

b.

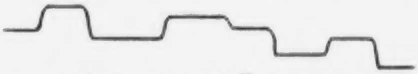


ọ↑ŋụ↓ mmaỹa a↓h̃ụ↑ 'that wine-drinker'

(*a↓h̃ụ↑* 'that')

Finally, there are nouns which take clauses as complements, as in the following example with the noun *i↓hi↑* 'reason':

(2.2-5)

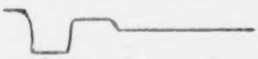


na↑ i↓hi na↑ mi↓r̃i↓ na↑ e↓zo↑ 'for the reason that rain was falling'

(*na↑* 'for', *i↓hi↑* 'reason', *na↑* 'that', *mi↓r̃i↓* 'rain', *na↑* progressive marker, *e↓zo↑* 'falling')

2.3 Compound nouns. Compound nouns in Igbo are identical on the surface to possessive constructions like *aỹa a↓gụ↓* 'the eyes of a leopard' but are distinguished from them by the fact that a postnominal adjective comes after the phrase rather than between its two parts. Some examples of compound nouns modified by postnominal adjectives are given below:

(2.3-1) a.

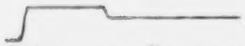


ụ↓lọ↑ a↓hya ukwu↓ 'a large shop'

(from *ụ↓lọ↑* + ↓ + *ahya↓* + *ukwu↓*)

'house' 'market' 'large'

b.

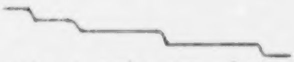


i↑ko m↓maỹa ọca↓ 'a white wine-cup'

(from *i↑ko↓* + ↓ + *m↑maỹa↓* + *ọca↓*)

'cup' 'wine' 'white'

c.



ụ↓mụ↓ agbọ↓ɣọ ọjọ↓ọ↓ 'wicked young women'

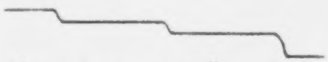
(from *ụ↓mụ↑* + ↓ + *a↑gbọ↓ɣọ↓* + *ọjọ↓ọ↓*)

'people' 'young women' 'wicked'

It is not possible in any of these examples to place the adjective between the two nouns. (Compare the position of the adjective in this case with that in example (2.1-8) above, where the second noun is a possessive.)

One can obtain noun compounds with a further degree of embedding. For example, the phrase

(2.3-2)



aka↓ iko m↓maỹa n↓ta↑ 'a small wine-cup handle'

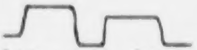
(from *aka↓* + ↓ + *i↑ko↓* + ↓ + *m↑maỹa↓* + *n↓ta↑*)

'handle' 'cup' 'wine' 'small'

has as its head the compound *aka iko mmaỹa* 'wine-cup handle'. ((2.3-2) is ambiguous, and may also be interpreted as 'the handle of a small wine-cup', in which case it is the last three words of the phrase rather than the first three which make up a syntactic unit.)

2.4 Complex noun phrases. There are a few quantifying expressions which stand outside the simple noun phrase. Examples are given below with the quantifiers *du↓m↑* 'all', *na↓anị↓* 'only', and *ni↓ile↓* 'all':

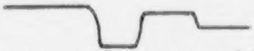
(2.4-1) a.



i↑te ↓a↑ du↓m↑ (from *ite↑* + *↓a↑* + *du↓m↑*)

'all these pots' 'pot' 'this' 'all'

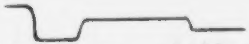
b.



eɣu a↓hụ↑ na↓anị↓ (from *eɣu↓* + *a↓h̃ụ↑* + *na↓anị↓*

'only that goat' 'goat' 'that' 'only'

c.

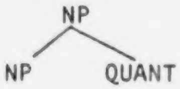


ụ↓mụ↑ ya ni↓ile↓ (from *ụ↓mụ↑* + *ya↓* + *ni↓ile↓*)

'all her children' 'children' 'her' 'all'

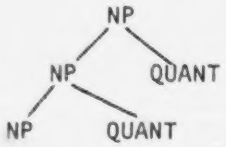
Let us assume that noun phrases like these have the structure

(2.4-2)



This assumption implies the existence of structures such as the one below, in which twc quantifiers are "stacked", one after another:

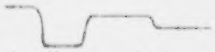
(2.4-3)



Such structures do not, in fact, occur -- I presume for semantic reasons. Evidence that (2.4-2) is, in fact, the correct structure will be given below, in section (6.2).

A second type of complex noun phrase consists of a head plus a noun phrase in apposition. Some examples are given below:

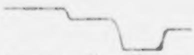
(2.4-4) a.



w̃u↓ỹe↑m I↓gwe↓(from *w̃u↓ỹe↑* + *m↓* + ↓ + *Igwe↓*)

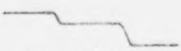
'my wife Igwe' 'wife' 'my'

b.



Igwe↓ w̃u↓ỹe↑m↓ 'Igwe my wife'

c.

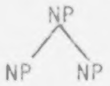


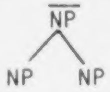
eɣu↓ ŋke↓ a↑ (from *eɣu↓* + ↓ + *ŋke↑* + *↓a↑*)[8]

'this goat' 'goat' 'thing' 'this'

I assume that noun phrases containing appositional phrases like those above may have either of the following structures, depending on whether the appositional phrase is restrictive or non-restrictive:

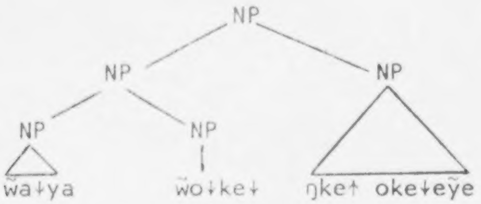
(2.4-5) a. Restrictive: b. Non-restrictive:





Notice that these structures predict the possibility of a "stacking" of restrictive appositional phrases, as in the example below:

(2.4-6)

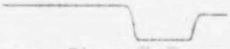


'his elder son'

(*w̃a↓* 'child', *ya↓* 'his', *w̃o↓ke↓* 'male person', *ŋke↑* 'thing', *oke↓eỹe↑* 'greater age')[9]

A third type of complex noun phrase consists of a head plus a relative clause, as in the examples below:

(2.4-7) a.

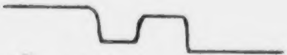


ego Ekwe ỹer̃e m 'the money Ekwe gave me'

(from *e↓go↓* + *Ekwe↓* + *ỹer̃e↑* + *m↓*)

'money' 'gave' 'me'

(2.4-7) b.



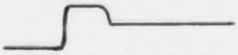
iħye a↓hụ↑ ọ↓ kwụrụ↑ 'that thing which he said'

(from *iħye↓ + a↓h̃ụ↑ + ọ↓ + kwụrụ↑*)

'thing' 'that' 'he' 'said'

There are also infinitival relatives, as in

(2.4-8)



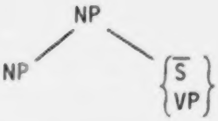
mgbe↑ i↓be akwha↓ 'a time to weep'

(from *mgbe↑ + i↓be↓ + akwha↓*)

'time' 'cry' 'tears'

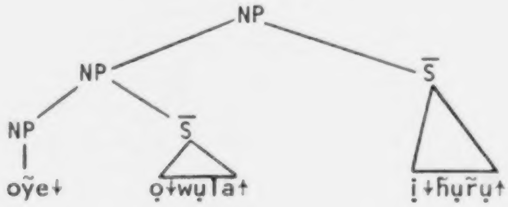
I assume that noun phrases with restrictive relative clauses like those above have the structure

(2.4-9)



This structure allows a stacking of relative clauses within the noun phrase, as in the example below:

(2.4-10)

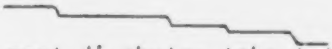


'anyone' 'he is' 'you see'

'anyone that you see'

and it also allows for an appositive NP after the relative clause, as in the following examples:

(2.4-11) a.

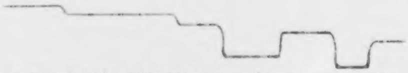


oce↓ dị ọhụ↓rụ ↓ŋke ↓a↑

(from *oce↓ + ↓dị ọhụ↓rụ↓ + ↓ + ŋ↑ke↓a↑*)

'chair' 'which is new' 'this thing'

(2.4-11) b.

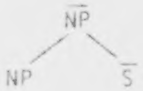


oce↓ dị ọhụ↓rụ↓ ŋke↑ n↓na↑m
'my father's new chair'
(ŋke↑ 'thing', *n↓na↑* 'father', *m↓* 'my')

The demonstrative *↓a↑* 'this' and the possessive noun phrase *n↓na↑m↓* must be encased in appositives here, because neither a possessive nor a demonstrative may follow a relative clause.

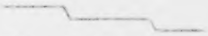
There are also non-restrictive relative clauses in Igbo, for which I assume the structure

(2.4-12)



An example is given below:

(2.4-13)

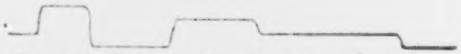


Ekwe↓ la a↓hya↓ 'Ekwe, who left the market'

(from *Ekwe↓* + *↓la a↓hya↓* '(who) left market')

Finally, a noun phrase may consist of a clause or infinitive phrase only; for example,

(2.4-14) a.

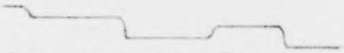


Na↑ ọ↓ lara↑ ahya↓ wụ ezi o↓kwu↓.

'That he left the market is a fact.'

(*na↑* 'that', *ọ* 'he', *lara↑* 'left', *ahya↓* 'market', *wụ↓* 'is', *ezi↓* 'true', *okwu↓* 'word')

b.



ị↓ta anụ↓ na e↑ÿe n↓dhụ↑.

'To eat meat gives health.'

(*ị↓ta↓* 'to eat', *anụ↓* 'meat', *na↑* (auxiliary), *e↑ÿe↓* 'giving', *n↓dhụ↑* 'health')

In summary, "complex" noun phrases (i.e., noun phrases with NP's, $\overline{S}$'s, or VP's as their heads) have the structures defined by the phrase-structure rules below:

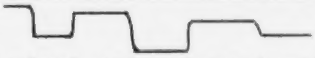
(2.4-15) a. $\overline{NP} \rightarrow NP \begin{Bmatrix} \overline{S} \\ NP \end{Bmatrix}$

b. $NP \rightarrow NP \begin{Bmatrix} QUANT \\ NP \\ \overline{S} \\ VP \end{Bmatrix}$

c. $NP \rightarrow \begin{Bmatrix} \overline{S} \\ VP \end{Bmatrix}$

2.5 Conjunction. Conjunction may take place either at or below the noun phrase level:

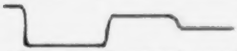
(2.5-1) a. At the noun phrase level:



n↓na↑ ya↓ na↑ nne↓ ya↓ 'his father and his mother'

(*n↓na↑* 'father', *ya↓* 'his', *na↑* 'and', *nne↓* 'mother')

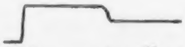
b. Below the noun phrase level:



n↓na na↑ nne↓ ya↓ 'his father and mother'

2.6 Some other sorts of noun phrases. There are some other sorts of noun phrases which have not yet been exemplified here. For example, there are noun phrases like the one below, which consists of a measure phrase plus object:

(2.6-1)

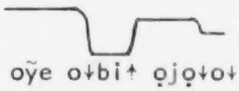


i↑ko m↓maỹa↓ 'a cup of wine'

(from *i↑ko↓* + ↓ + *m↑maỹa↓*)

There are also noun phrases which contain modifying noun phrases. The following is an example:

(2.6-2)



oỹe o↓bi↑ ọjọ↓o↓ 'a mean person'

(from *oỹe↓* + ↓ + *o↓bi↑* + *ọjọ↓ọ↓*)

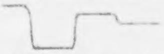
'someone' 'heart' 'wicked'

I have not been able to find any examples of noun phrases consisting of a head plus a prepositional phrase. Direct translations into Igbo of English noun phrases such as *the book on the table* are ungrammatical.

3. The Syntactic Distribution of the Associative ↓.

The reader will undoubtedly have noticed that the associative ↓ appears in many of the model noun phrases of the preceding section. In particular, it is found in the following environments within the noun phrase:

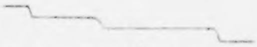
(3-1) a. At the boundary between a prenominal numeral and the noun or prenominal adjective which follows it:



o↓tu↑ e↓ɣu↓ 'one goat'

(from *o↓tu↑* + ↓ + *eɣu↓*)

'one' 'goat'

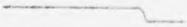


o↓tu n↓nukwu ụ↓lọ↑ 'one large house'

(from *o↓tu↑* + ↓ + *n↑nukwu ụ↓lọ↑*)

'one' 'large house'

b. At the boundary between a prenominal adjective and the noun it modifies:

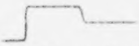


obodobo u↓te↓ 'a wide mat'

(from *obodobo↓* + ↓ + *ute↓*)

'wide' 'mat'

c. At the boundary between a verbal noun and its NP-complement:

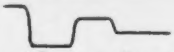


ọ↑za ↓ ezi 'compound-sweeper'

(from *ọza↑* + ↓ + *e↑zi↓*)

'sweeper' 'compound'

(3-1) d. At the boundary between the two elements of a compound noun:

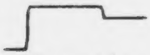


ụ↓lọ↑ a↓̲hya↓ 'shop'

(from *ụ↓lọ↑* + ↓ + *ahya↓*)

'house' 'market'

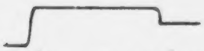
e. At the boundary between a possessive NP and whatever precedes it within the noun phrase:



a↑hụ e↓̲le↓ 'the body of a deer'

(from *a↑hụ↓* + ↓ + *ele↓*)

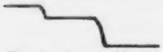
'body' 'deer'



a↑hụ ọma e↓̲le↓ 'the beautiful body of a deer'

(*ọma↓* 'beautiful')

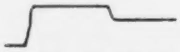
f. At the boundary between two noun phrases in apposition:



Da↓̲ La↓dha↑ (from *Da↓* + ↓ + *La↓dha↑*)

'Mother Ladha' 'mother'

g. At the boundary between a measure phrase and the NP which follows it:

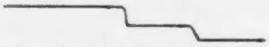


i↑ko m↓̲maya↓ 'a cup of wine'

(from *i↑ko↓* + ↓ + *m↑mãya↓*)

'cup' 'wine'

h. At the boundary between an ordinal numeral and whatever precedes it within the NP:



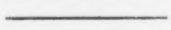
akwụkwọ ↓Ogụ ↓̲ atọ↓ 'Ogu's third book'

(from *akwụkwọ↓ Ogu↑* + ↓ + *a↑tọ↓*)

'Ogu's book' 'third'

There are also syntactic boundaries within the noun phrase in Igbo which are NOT marked with an associative ↓. In particular, the following positions are not marked with a ↓:

(3-2) a. The boundary between a noun and a postnominal adjective:

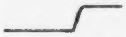


akwụkwọ ọca↓ 'a white paper'

(from *akwụkwọ↓* + *ọca↓*)

'paper' 'white'

b. The boundary between a noun and a postnominal cardinal numeral:

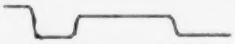


ite a↑tọ↓ 'three pots'

(from *ite↑* + *a↑tọ↓*)

'pot' 'three'

c. The boundary between a noun phrase and the quantifier which modifies it:

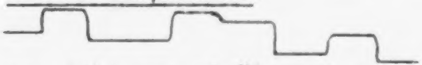


ụ↓mụ↑ ya ni↓ile↓ 'all her children'

(from *ụ↓mụ↑* + *ya↓* + *ni↓ile↓*)

'children' 'her' 'all'

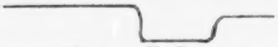
d. The boundary between a noun and the clause which is its complement:



na↑ i↓hi na↑ mi↓r̃i↓ na↑ e↓zo↑ 'for the reason that rain was falling'

(repeated from (2.2-5))

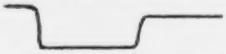
e. The boundary between a noun phrase and the relative clause which modifies it:



ego Ekwe ↓ỹer̃e↑ m↓ 'the money Ekwe gave me'

(repeated from (2.4-7 a))

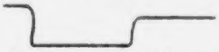
(3-2) f. The boundary between two conjoined nouns or noun phrases:



o↓se na↑ nnu↓ 'pepper and salt'

(from *o↓se↑* + *na↑* + *nnu↓*)

'pepper' 'and' 'salt'



O↓gu na↑ Ekwe↓ 'Ogu and Ekwe'

If we continue to define a simple noun phrase by means of the phrase-structure rule of (2.1-1), repeated below:

(3-3) $\mathrm{NP} \rightarrow (\mathrm{NUM})(\mathrm{ADJ}^{*})\overline{\mathrm{N}}(\mathrm{ADJ}^{*})(\mathrm{NUM})(\mathrm{NP}_{\mathrm{POSS}})\left(\begin{Bmatrix}\mathrm{DEM}\\ \mathrm{NUM}_{\mathrm{ORD}}\end{Bmatrix}\right)$

then it will not be easy to state a rule which inserts the associative ↓ in just the right positions within the noun phrase, that is, which inserts the associative ↓ into the environments of (3-1) but not into the environments of (3-2). The rule below is about the best we can do within this framework:

(3-4) Insert the associative morpheme ↓ in the environment

$$_{\mathrm{NP}}[\ldots\begin{Bmatrix}\mathrm{ADJ}\\ \mathrm{NP}\\ \overline{\mathrm{N}}\\ \mathrm{N}\\ \mathrm{NUM}\end{Bmatrix}[\ldots]\ \underline{\qquad}\ \begin{Bmatrix}\mathrm{N}\\ \overline{\mathrm{N}}\\ \mathrm{NP}\\ \mathrm{NUM}_{\mathrm{ORD}}\\ \mathrm{ADJ}_{\mathrm{PRE}}\end{Bmatrix}[\ldots]\ldots]$$

where $\mathrm{ADJ}_{\mathrm{PRE}}$ stands for "prenominal adjective".

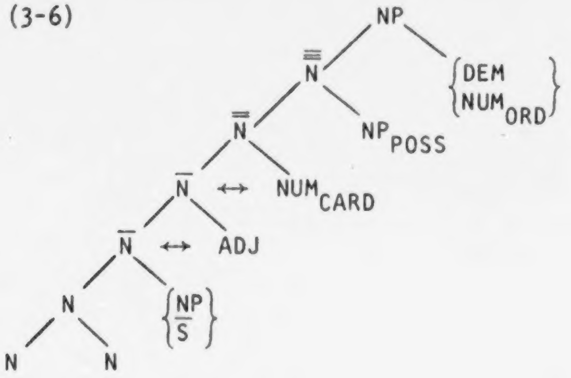
Rule (3-4) is not only extremely cumbersome, it is also too general, in that it predicts, for example, that there will be an associative ↓ between the head NP and the subject of a relative clause. The example below shows that there is in fact no associative ↓ in this position:

(3-5) ego Ekwe↓ ỹer̃e↑m↓ 'the money Ekwe gave me'

(repeated from (2.4-7 a))

Similarly, rule (3-4) incorrectly suggests that there might be an associative ↓ between the indirect and direct objects of a relative clause, since these are consecutive NP's within a NP. It is not at all clear how to write a rule in this framework which will account for all occurrences of the associative ↓ without at the same time incorrectly predicting an associative ↓ in positions of this sort. We can avoid this problem and the necessity of distinguishing between prenominal and postnominal adjectives[10] in the structural description of the rule if we assume a binary structure for all nominal constituents. To see that this is so, let us assume for a moment that a "simple" noun phrase in Igbo has the structure shown below:

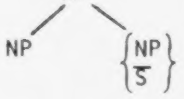
(3-6)



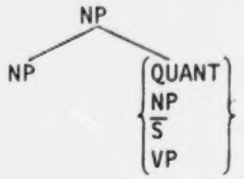
The bi-directional arrows between the constituents $\overline{N}$ and ADJ, which make up a $\overline{N}$-phrase, and between the constituents $\overline{N}$ and NUM_{CARD} which make up a $\overline{\overline{N}}$-phrase indicate that these constituents may take either order; that is, the numeral or the adjective may come before the $\overline{N}$-phrase instead of after it. (See secion 2.1 above). In labelling the nodes of this NP-tree, I have gone "up" one level (by adding a bar) whenever that is necessary to insure the correct order of elements within the noun phrase. For example, I have assumed that a $\overline{N}$-phrase combines with a cardinal numeral to produce a new type of constituent, a $\overline{\overline{N}}$-phrase, because the product of this combination cannot in turn combine with an adjective or cardinal numeral, as one would expect it to do if it were a $\overline{N}$-phrase.

The binary structure which I have proposed here for the simple noun phrase is found also in complex noun phrases, for which I have assumed the structures below:

(3-7) For a noun phrase with a modifying non-restrictive relative clause or appositive:



(3-8) For a noun phrase with a modifying quantifier, or with a restrictive relative clause or appositive NP, or with an infinitival relative:



There are also noun phrases which consist of a clause or infinitive phrase only; noun phrases of this sort do not necessarily have a binary structure.

Assuming the noun phrase structure which is proposed in (3-6), (3-7), and (3-8), we may list the syntactic environments in which the associative † appears in the following way:

(3-9) a. It appears between two nouns which make up a compound noun.

b. It appears between a N and a NP which make up a $\bar{N}$-phrase, but not between a N and a $\bar{S}$ which do so.

c. It appears between a $\bar{N}$-phrase and an ADJ which together make up a $\bar{N}$-phrase if the ADJ is the first constituent of the phrase, but not if it is the second (i.e., not if the adjective is post-nominal.)

d. It appears between a $\bar{N}$-phrase and a possessive NP which together make up a $\bar{\bar{N}}$-phrase if the numeral is the first element of the phrase, but not if it is the second (i.e., not if the numeral is postnominal).

e. It appears between a $\bar{\bar{N}}$-phrase and a possessive NP which together make up a $\bar{\bar{N}}$-phrase.

f. It appears at the boundary between a $\bar{\bar{\bar{N}}}$-phrase and an ordinal numeral.

g. It aopears at the boundary between two NP's in apposition.[11]

In summary, the associative ↓ appears between the two constituents of a binary phrase with one of the constituent structures shown below:

$$(3\text{-}10)\quad [[\left\{\begin{matrix}\text{NP}\\ \overline{\overline{\overline{\text{N}}}}\\ \overline{\overline{\text{N}}}\\ \text{N}\\ \text{ADJ}\\ \text{NUM}\end{matrix}\right\} \ldots]\underline{\quad\quad}[\left\{\begin{matrix}\text{NP}\\ \overline{\text{N}}\\ \text{N}\\ \text{NUM}_{\text{ORD}}\end{matrix}\right\} \ldots]]$$

Notice that it is not necessary to specify that the whole phrase must be a nominal phrase (N, $\overline{N}$, N, $\overline{N}$, NP or $\overline{NP}$) because no other phrase has the prescribed internal structure.

While this formulation of the rule of Associative ↓ Insertion avoids the problem of over-application which characterized the rule of (3-4), and while it eliminates the need for differentiating between prenominal and postnominal adjectives in the structural description of the rule, the number of different syntactic categories mentioned here is very great. However, the statement of the rule can be simplified dramatically if we make use of the $\overline{X}$-notation proposed by Chomsky (1970), which treats syntactic categories as bundles of syntactic features, thereby providing a simple way of referring to certain natural classes of syntactic categories. For example, the category-variables (X, $\overline{X}$, $\overline{X}$, etc.) which are provided by this notation are a mechanism for referring to any member of a particular "type", where the type 0 categories (referred to by "X") are N, A, and V, the type I categories (referred to by "$\overline{X}$") are $\overline{N}$, $\overline{A}$, and $\overline{V}$, and so forth. Category-variables are used in expressing phrase-structure schema such as that given below:

$$(3\text{-}11)\qquad \overline{X} \rightarrow X \left\{\begin{matrix}\text{PP}\\ \text{S}\\ \text{VP}\end{matrix}\right\}$$

This rule schema expresses the generalization that nouns, verbs, and adjectives take complements of the same sort, so that the categories $\overline{N}$, $\overline{A}$, and $\overline{V}$ have parallel internal structures. Bresnan (1976) argues for the use of category-variables in stating the transformations of Wh-fronting and Comparative deletion in English.

The natural classes of categories which are of interest to us here are those which cut across the set of syntactic categories in the other direction, pulling together the set of categories $\{N, \overline{N}, \overline{N}, \ldots\}$, as opposed to $\{V, \overline{V}, V \ldots\}$ and $\{A, \overline{A}, \overline{A} \ldots\}$. Category-classes of this sort are distinguished from one another by means of syntactic features. In his public lectures at the 1974 LSA Summer Institute at the University of Massachusetts at

Amherst, Chomsky proposed the following feature matrices for the major syntactic categories:

$$(3\text{-}12)\quad \{N,\ \bar{N},\ \bar{\bar{N}},\ \ldots\} = \begin{bmatrix}-V\\+N\end{bmatrix}$$

$$\{V,\ \bar{V},\ \bar{\bar{V}},\ \ldots\} = \begin{bmatrix}+V\\-N\end{bmatrix}$$

$$\{A,\ \bar{A},\ \bar{\bar{A}},\ \ldots\} = \begin{bmatrix}+V\\+N\end{bmatrix}$$

The overlapping of the feature-representations of major categories allows for the expression of cross-categorial processes of certain kinds. For example, the feature representations given above allow for the expression of syntactic processes which apply to the categories $\bar{N}$ and $\bar{A}$, which share a positive value for the feature [±N], but not to $\bar{V}$, which has a negative value for this feature. Similarly, we may expect the categories $\bar{V}$ and $\bar{A}$ (which share the feature [+V]) to undergo certain syntactic processes which do not apply to $\bar{N}$. However, if the feature system proposed here is the correct one, then we would not expect to find syntactic processes which apply to $\bar{V}$ and $\bar{N}$ but not to $\bar{A}$, for these two categories have nothing in common except their type, and that is also shared by the category $\bar{A}$.[12]

Now let us return to the rule of Associative ↓ Insertion (3-10). According to this rule, the associative ↓ is inserted when the first element of the phrase is a NP, $\bar{N}$, N, N, ADJ, or cardinal number. If cardinal numerals have the same [+N, +V] feature composition as adjectives,[13] then it is clear what this set of categories has in common: the feature [+N]. Similarly, the second member of the phrase must be a NP, $\bar{N}$, N, or ordinal numeral; the rule does not apply if it is a $\bar{S}$, S, VP, ADJ, cardinal numeral, or demonstrative.[14] We assumed above that cardinal numerals have the same [+N, +V] feature specification as adjectives. If demonstratives also share this "adjectival" feature specification, while ordinal numerals have the [+N, -V] feature specification of the purely nominal categories, then what differentiates the categories which take an associative ↓ before them from those which do not is the feature [±V]; those which take an associative ↓ before them have the feature [-V], while those which do not do so have the feature [+V]. In summary, the associative ↓ is inserted when the first constituent of the phrase is a member of a [+N] category and the second constituent is a member of a [-V] category. The rule of Associative ↓ Insertion may thus be stated as follows:

(3-13) Associative ↓ Insertion.

$$[[\ldots]_{[+N]}\ {}_{[-V]}[\ldots]]$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

Having motivated the structural description of the rule of Associative ↓ Insertion, I should perhaps also say something about the structural change which it creates, particularly about the assumption I have made here that the inserted tone marker has the status of a morpheme. There are two kinds of evidence for this assumption: first, the fact that the environment in which the associative ↓ is inserted is a purely syntactic one, leading one to suppose that what is being inserted is a syntactic entity. A second sort of evidence is the striking similarity between the associative morpheme in Igbo and more conventional morphemes in other languages which perform the same syntactic function. For example, Tagalog[15] makes use of a relational particle *na*/ŋ in its noun phrases. (The phonological shape of the particle depends on the final consonant of the independent form of the preceding word. If it is [h], [?], or [n], then the particle takes the form ŋ; otherwise it takes the form *na*.) Some examples of Tagalog noun phrases are given below. Notice the relational particle between the two constituents of each phrase;

(3-14) a. doktor na bantag 'famous doctor'

'famous'

b. bantag na doktor 'famous doctor'

'famous'

c. ladis na sa bata 'the child's pencil'

'pencil' 'child's'

d. sa bata ŋ ladis 'the child's pencil'

'child's' 'pencil'

e. dalawa ŋ mansanas 'two apples'

'two' 'apples'

f. pagkai ŋ niluto mo 'the food you cooked'

'food' 'cooked' 'you'

(3-14) g. niluto mo ŋ pagkain 'the food you cooked'

'cooked''you''food'

h. ito ŋ damit 'this dress'

'this''dress'

i. ito ŋ hinog na manga 'this ripe mango'

'this''ripe' 'mango'

Another language which makes use of a relational particle in its noun phrases is Persian,[16] where the relational particle, called the *ezāfe*, takes the form *e* if the preceding word ends with a consonant, and *ye* if it ends with a vowel. Some examples are given below:

(3-15) a. yar e aziz 'a dear friend'

'friend''dear'

b. baradar e m 'my brother'

'brother''my'

c. kostan e Hafiz 'the killing of Hafiz'

'killing'

d. por e mardom 'full of people'

'full''people'

Except for certain exceptional cases involving adverbial and possessive modifiers, it is apparently the case that any two elements of a nominal phrase in Tagalog will have the particle *na*/ŋ between them. However, the rule of Ezāfe insertion in Persian, like the rule of Associative ↓ Insertion in Igbo, is selective. Thus the ezāfe does not appear after a demonstrative or cardinal numeral, as in the following example:

(3-16) in du-ta kolah e siyah e Hafiz 'these two black hats of Hafiz'

'these''two'hats' 'black''Hafiz'

Nor is there an ezāfe before a prepositional phrase or relative clause as in the example:

(3-17) mard e mossen - i ba labas e farsude ke
'man' 'old' 'with''clothes' 'shabby' 'that'
diruz inja bud
'yesterday''here''was'
'the old man with shabby clothes that was here yesterday'

If prepositional phrases and clauses are [-N] categories, as one assumes they are, and if demonstratives and cardinal numerals are [+V] categories, as we have assumed they are in Igbo, and if Persian noun phrases have the same binary structure which we have assumed for Igbo, then the rule which determines where the ezāfe will appear within a noun phrase can be stated simply as follows:

(3-18) Ezāfe Insertion.

$[[\ldots]_{[-V][+N]}[\ldots]]$

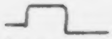
s.d. 1 2

s.c. Insert the morpheme [(y)e] between 1 and 2.

This rule is, strikingly, just the inverse of the Igbo rule of Associative ↓ Insertion. In fact, in a deeper sense, the rules are identical, for "specifier" elements such as demonstratives and cardinal numerals lie to the left of the head noun in Persian, but to the right of it in Igbo. Thus, in both rules, the [-V] specification serves to prevent the insertion of the relational morpheme between a demonstrative or cardinal numeral and the phrase which it modifies. In addition, neither language inserts the relational morpheme at the boundary between a relative clause and its head.

Notice that we have had to assume here that demonstratives are a [+V] category in Persian, so as to account for the fact that there is no ezāfe between a demonstrative and the constituent which it modifies. This assumption is a plausible one, since demonstratives are rather adjectival in function, and one assumes, intuitively, that they should have the same major syntactic features as adjectives. However in Igbo there is a pitch drop between the demonstrative *↓a↑* 'this' and whatever precedes it in the string. For example, there is a pitch drop between the head noun *ite↑* 'pot' and the demonstrative *↓a↑* in the phrase

(3-19)



i↑te↓ a↑ 'this pot'

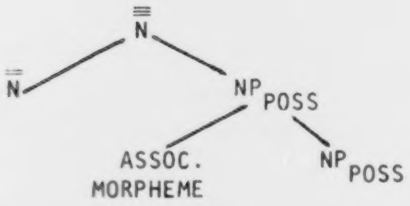
If the pitch drop between the two elements of the phrase above is to be inserted by the rule of Associative ↓ Insertion, then demonstratives in Igbo must be a [-V] category; that is, demonstratives in Igbo must have a different syntactic-feature composition from demonstratives in Persian. This would be an unfortunate result, since in general one assumes that parallel syntactic categories have parallel syntactic-feature specifications in all languages.

Fortunately, it is not necessary to use the rule of Associative ↓ Insertion to account for the pitch drop between the two elements of a phrase like (3-19), for the following reason: There are only two demonstratives in Igbo, ↓*a*↑ 'this' and *a*↓*h̃ụ*↑ 'that', and the tone shape of *a*↓*h̃ụ*↑ is such that it is impossible to tell whether there is an associative ↓ before it or not. (That is because the associative ↓ would be transposed with the initial high-toned vowel of *a*↓*h̃ụ*↑, replacing its lexical ↓, and leaving the word with the same tone shape it started with.) Thus it is possible that the ↓ which appears before ↓*a*↑ in (3-19) is part of the lexical representation of this word, and not an associative ↓ at all. Such an analysis is made more plausible by the fact that there are a handful of words in Igbo which do have initial pitch drops in lexical representation. The object pronoun ↓*aỹị*↓ 'us' and the emphatic particle ↓*rị*↑ are two such words; they have a pitch drop before them in every syntactic environment. If the demonstrative ↓*a*↑ 'this' is a word of this type, then it will not be necessary to use the rule of Associative ↓ Insertion to account for the pitch drop before ↓*a*↑, and demonstratives in Igbo can be assigned the same [+N, +V] feature matrix as demonstratives in Persian.

4. Accounting for the Surface Position of the Associative ↓

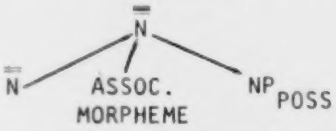
In Chapter II and in the first section of this chapter, I argued that the syntactic position of the associative ↓ varies slightly from one construction to another within the noun phrase. In particular, I argued that in the common noun possessive the associative ↓ has cliticized to the possessive noun phrase, so that the whole phrase has the underlying structure shown below:

(4-1)


$\overline{\overline{N}}$
$\overline{\overline{N}}$
NP_{POSS}
ASSOC.
MORPHEME
NP_{POSS}

In the proper name possessive, on the other hand, the associative morpheme does not cliticize to the possessive noun phrase, and the phrase as a whole has the structure shown below:

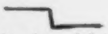
(4-2)


$\overline{N}$
$\overline{\overline{N}}$
ASSOC.
MORPHEME
NP_{POSS}

It is this difference in syntactic structure of the two constructions which gives rise to the four tonal differences between them which are outlined below:

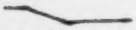
(4-3) a. In the proper noun possessive, but not in the common noun possessive, the associative ↓ is realized as a falling glide on the head noun when the possessive noun phrase begins with a consonant. For example:

Common Noun Possessive:



isi↓ ji↓ 'the top of a yam'

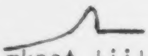
Proper Noun Possessive:



isi↓ Chi↓ 'Chi's head'

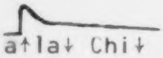
b. In the common noun possessive, but not in the proper noun possessive, the rules of Streamlining and ↑-Retraction do not affect a ↑ at the end of the head noun when the possessive noun phrase begins with a consonant. For example:

Common Noun Possessive:



mkpa↑ ↓ji↓ 'a stick of yams' (*mkpa↑*)

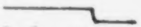
Proper Noun Possessive:



a↑la↓ Chi↓ 'Chi's land' (*ala↑*)

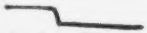
(4-3) c. In the common noun possessive, but not in the proper noun possessive, the associative ↓ metathesizes with a high-toned syllabic segment at the beginning of the possessive noun phrase. For example:

Common Noun Possessive:



isi e↓γu↓ 'the head of a goat' (*eγu↓*)

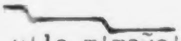
Proper Noun Possessive:



isi↓ Ekwe↓ 'Ekwe's head' (*Ekwe↓*)

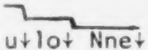
d. In the common noun possessive, but not in the proper noun possessive, the associative ↓ metathesizes with a syllabic nasal at the beginning of the possessive noun phrase if the segment which follows that syllabic nasal is also nasal:

Common Noun Possessive:



ụ↓lọ m↓maỹa↓ 'bar' (*m↑maỹa↓*)

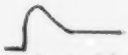
Proper Noun Possessive:



ụ↓lọ↓ Nne↓ 'mother's house' (*N↑ne↓*)

Most nominal phrases in Igbo share the tonal properties of the common noun possessive -- there are just two other constructions which resemble the proper noun possessive. The first of these is the construction which is formed by combining an agentive noun with an object NP. In this construction, as in the proper noun possessive, a ↓ at the end of the first constituent is retracted before the associative ↓ even when the following constituent begins with a consonant, and the associative ↓ is then realized as a falling glide on the final syllable of the head noun. An example is given below:

(4-4)



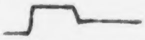
ọ↑kọ↓ ji↓ 'yam-planter"

(from *ọkọ↑* + ↓ + *ji↓*)

'planter' 'yams'

In addition, as in the proper noun possessive, ↓-Metathesis and Syllabic-Nasal Raising do not apply. Examples are given below:

(4-5) a.

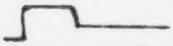


ọ↑bọ↓ anụ↓ 'meat cutter'

(from *ọbọ*↑ + ↓ + *anụ*↓)

'cutter' 'meat'

b.



ọ↑ŋụ↓ mmay̆a↓ 'wine drinker'

(from *ọ*↑*ŋụ*↓ + ↓ + *m*↑*may̆a*↓

'drinker' 'wine'

Adjective and adverb-phrases which are formed by reduplication of nouns also share the tonal properties of the proper noun possessive. Some examples are given below:

(4-6) Adverb Phrases

a. ọsọ↓ ọsọ↓ 'quickly' (from *ọsọ*↓ 'race')

b. ŋgwa↓ ŋgwa↓ 'quickly'

Adjective Phrases

c. ikhe↓ ikhe↓ 'rathar hard' (from *ikhe*↓ 'strength')

d. i↓che↓ iche↑ 'different' (from *i*↓*che*↑ 'difference')

e. ọba↑ra↓ ọbara↑ 'red' (from *obara*↑ 'blood')

f. uhye↓ uhye↓ 'brownish-red'(from *uhye*↓ 'camwood')

g. mme↓ mme↓ 'red'

Notice that ↓-Metathesis has not applied in (a), (b), (c), (d), or (f) above, even though the second elements of these phrases begin with high-toned syllabic segments. Similarly, Syllabic Nasal Raising has not applied in (g), even though the second element of the phrase begins with a syllabic nasal which is followed by a nasal consonant.

Since all other nominal constructions have the same tonal properties as the common noun possessive, I assume that in all nominal constructions except these three, the associative ↓ has cliticized to the second element of the construction.

It is a simple matter to write a rule of ↓-Cliticization which will account for the position of the associative ↓ in those constructions in which it has cliticized to the second element of the phrase. A rule for this process can be stated as follows:

(4-7) ↓-Cliticization

$$[\downarrow] \quad {}_{[N]}[\ldots]$$

s.d. 1 2

s.c. Chomsky-adjoin 1 to 2.

What is more difficult is finding a way to prevent this rule from applying to proper noun possessives, to agentive constructions, and to adjectives and adverbs formed by reduplication of nouns. I assume that phrases of the last type are lexical items which can simply be marked in the lexicon as exceptions to rule (4-7). However, proper noun possessives are certainly not lexical items, and agentive constructions are probably not either, since the "object" NP may have internal structure of its own, as in the phrase

(4-8) .

ọ↑ŋụ↓ mmay̆a ọma↓ 'a drinker of good wine'

(from *ọ↑ŋụ↓ + ↓ + m↑may̆a↓ + ọma↓*)

For that reason, I propose to include the fact that ↓-Cliticization does not apply to these constructions in the statement of the rule itself, which will therefore be stated as follows:[17]

(4-9) ↓-Cliticization

$$[[\ldots]_{\begin{bmatrix}\langle +N\rangle_a \\ \langle -\text{AGENTIVE}\rangle_b\end{bmatrix}} \quad [\downarrow]_{\begin{bmatrix}+N \\ \langle +\text{PROPER}\rangle_c \\ \langle -\text{POSSESSIVE}\rangle_d\end{bmatrix}} \quad [\ldots]]$$

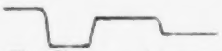
s.d. 1 2 3

s.c. Chomsky-adjoin 2 to 3.

Conditions: a ⊃ b and c ⊃ d

The rule above Chomsky-adjoins the associative ↓ to the nominal phrase which follows it.[18] The conditions on the rule state that it does not apply when the constituent which precedes the associative ↓ is an agentive noun, or when the constituent which follows it is a proper name possessive. Notice that it would be too strong to say that the rule does not apply when the constituent following the associative ↓ is a proper noun, for it does apply in appositional phrases like the following:

(4-10)



w̃u↓ỹe↑m I↓gwe↓ 'my wife Igwe'

(from *w̃u↓ỹe↑* + *m↓* + ↓ + *Igwe↓*)

Even speakers who do not pronounce the name *Igwe* with an internal pitch drop in isolation will give it a pitch drop in this syntactic context. Since it is only POSSESSIVE proper nouns which do not undergo the rule, it is necessary to assume that the rule of ↓-Cliticization can distinguish possessive noun phrases from non-possessive ones; presumably possessive NP's are marked with a distinguishing feature when they are introduced by the phrase-structure rule which combines a N-phrase with a possessive NP to form a $\overline{\overline{N}}$-phrase.

Having accounted for the cliticization of the associative ↓ to the element which follows it in most nominal phrases in Igbo we must now revise the rule of ↓-Metathesis, which applies to the output of this cliticization process. In Chapter II, I proposed the following statement of this rule:

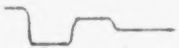
(4-11) $_{NP}[$↓ [+syll] ... ↓

s.d. 1 2 3 4

s.c. Transpose 1 with 2.

By now it should be clear that this rule applies not just when the associative ↓ has cliticized to the beginning of a noun phrase, but also when the nominal phrase to which it has attached is of some "lower" type. For example, it applies in the following cases in which the phrases to which the associative ↓ has cliticized are a noun and a $\overline{N}$-phrase respectively:

(4-12) a.



ụ↓lọ↑ a↓hya↓ 'a shop'

(from *ụ↓lọ↑* + ↓ + *ahya↓*)
'house' 'market'

(4-12) b.

obodobo u↓te↓ 'a wide mat'

(from *obodobo↓* + ↓ + *ute↓*)

'wide' 'mat'

In order to account for the position of the associative ↓ in these phrases, we must generalize the statement of the rule of ↓-Metathesis in the following way:

(4-13) ↓-Metathesis

$$_{[+N]}[\downarrow\ [+\text{syll}] \ldots \downarrow \ldots]$$

s.d. 1 2 3 4 5

s.c. Transpose 1 with 2.

Stated in this way, the rule of ↓-Metathesis will apply even in phrases like those of (4-12), in which the constituent to which the associative ↓ has adjoined is not a NP, but a nominal constituent of some lower type.

5. Postnominal Cardinal Numerals and Possessive Pronouns: Accounting for the "Pseudo" Associative ↓

5.1 Postnominal cardinal numerals. If we assume that the class of cardinal numerals shares with the class of adjectives the syntactic features [+N, +V], then the rule of Associative ↓ Insertion (repeated below)

(5.1-1) Associative ↓ Insertion.

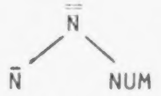
$$[[\ldots]_{[+N][-V]}[\ldots]]$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

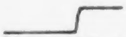
will not apply to a nominal phrase with the structure

(5.1-2)



Thus there is no associative ↓ between the head noun *ite↑* 'pots' and the numeral *a↑tọ↓* 'three' in the phrase

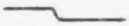
(5.1-3)



ite a↑to↓ 'three pots'

However, when the head of the phrase ends with a high-toned syllable, as in the example

(5.1-4)



oce↓ atọ↓ 'three chairs'

(from *oce↓* + *a↑tọ↓*)

'chairs' 'three'

there is a drop in pitch between the head and the numeral which I will call a "pseudo" associative ↓. How are we to account for the drop in pitch between the two constituents of this phrase?

The presence of the pseudo associative ↓ in (5.1-4) is predicted by the analysis which has been proposed here if we make one assumption -- that the boundary between a $\bar{N}$-phrase and the post-nominal cardinal numeral which modifies it is a "weak" word-boundary in Igbo. In other words, the phrase of (5.1-4) must have the underlying structure shown below, with only a single word-boundary between the two constituents of the phrase:

(5.1-5) *##* oce ↓*#* a↑tọ↓ *##*

The surface contour (5.1-4) follows automatically from this assumption, because the rule of Right Streamlining (repeated below) will apply to delete the underlying ↑ of *a↑tọ↓*:

(5.1-6) Right Streamlining.

↓ (#) ([+syll]) [+tone]

s.d. 1 2 3 4

s.c. Delete 4.

Furthermore, the ↓ at the end of *oce↓* in (5.1-5) will remain in the surface form, as a "pseudo" associative ↓, because the rule of Like-Tone-Marker Deletion (repeated below) deletes a ↓ only if it is followed by a strong word-boundary:

(5.1-7) Like-Tone-Marker Deletion.

$$\begin{array}{lcccccc} & \begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} & <\#\#> & \ldots & \begin{vmatrix}+\text{tone}\\ <+\text{fall}>\end{vmatrix} & \ldots & \$\$ \\ \text{s.d.} & 1 & 2 & 3 & 4 & 5 & 6\end{array}$$

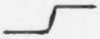
s.c. Delete 1.

I therefore conclude that the boundary between a postnominal cardinal numeral and the $\overline{\text{N}}$-phrase which it modifies is a weak (single) word boundary in Igbo, and that the "pseudo" associative ↓ which appears between the numeral and the head in phrases like (5.1-4) is just the final ↓ of the head $\overline{\text{N}}$, which fails to delete before a weak word boundary.

5.2 Possessive pronouns. The tonal behavior of the monosyllabic possessive pronouns *m*↓ 'my', *gị*↓ 'your'(sg), *ya*↓ 'his/her/its', and *h̃a*↓ 'their' exactly parallels that of the cardinal numerals, in that there is a drop in pitch before the possessive pronoun just in case the $\overline{\text{N}}$-phrase which it modifies ends with a ↓ in the underlying form. Contrasting examples are given below:

(5.2-1) where the $\overline{\overline{\text{N}}}$-phrase ends with a ↓ in the underlying form

a.

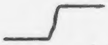


ite↑ m↓ 'my pot'

(from *ite*↑ + *m*↓)

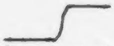
'pot' 'my'

b.



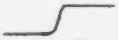
ite↑ gị↓ 'your pot'

c.



ite↑ ya↓ 'his pot'

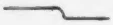
d.



ite↑ h̃a↓ 'their pot'

(5.2-2) where the $\overline{\overline{\text{N}}}$-phrase ends with a ↓ in the underlying form

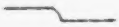
a.



oce↓ m↓ 'my chair'

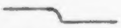
(from *oce*↓ + *m*↓)

(5.2-2) b.



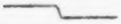
oce↓ gị↓ 'your chair'

c.



oce↓ ya↓ 'her chair'

d.



oce↓ h̃a↓ 'their chairs'

The monosyllabic possessive pronouns can be handled in much the same way as the cardinal numerals. Thus, if we assume (i) that the rule of Associative ↓ Insertion does not insert a ↓ at the boundary between a possessive pronoun and the phrase which it modifies, and (ii) that there is only a single word boundary between a monosyllabic possessive pronoun and whatever precedes it in the phrase, then the phrases of (5.2-1) and (5.2-2) must have the underlying structures shown below:

(5.2-3) a. ite↑ # gị↓ (for 5.2-1b))

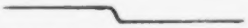
b. oce↓ # ya↓ (for 5.2-2c))

Since the rule of Like Tone Marker Deletion does not delete a ↓ which is followed by just a single word boundary, and since no other rules apply, the underlying tone contours of (5.2-3) become the surface tone contours of (5.2-1) and (5.2-2).

Now consider the two assumptions on which this result is based. The first assumption, that the rule of Associative ↓ Insertion does not insert a ↓ between a possessive pronoun and the N-phrase which it modifies, follows automatically if possessive pronouns are sufficiently adjectival in character to qualify as a [+V] category, because the rule of Associative ↓ Insertion requires a [-V] category in second position in the phrase. But there are many languages in which possessive pronouns behave more like determiners and adjectives than like other possessive noun phrases; for example, in French and Spanish, the possessive pronouns are the only possessives which take prenominal position, and, like the determiners and adjectives, they undergo agreement with the head noun. Thus it is plausible to assume that, in some languages at least, possessive pronouns have the same [+N, +V] feature specification as the determiners and adjectives. The fact that there is no associative ↓ between the head noun and the possessive pronoun in the phrases of (5.2-1) suggests that Igbo is such a language.

The second assumption, that there is a weak word boundary before a monosyllabic possessive pronoun, is equally plausible; in fact, a monosyllabic possessive pronoun may even cliticize to the head noun in Igbo, as in the phrase below:

(5.2-4)



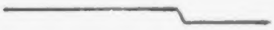
akwụkwọ↓ gị ọcha↓ 'your white paper'

(from *akwụkwọ*↓ + *ọcha*↓ + *gị*↓)

'paper' 'white' 'your'

As evidence that this word order arises from the application of a cliticization rule, and not from a variation in the order of adjectives and possessives in general, we may note that the word order of (5.2-4) is possible only when the possessive is a monosyllabic pronoun. For example, the phrase

(5.2-5)



akwụkwọ ọcha↓ Ekwe↓ 'Ekwe's white paper'

does not allow the alternate word order

(5.2-6) *akwụkwọ Ekwe ọcha

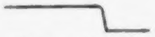
If we assume that a monosyllabic possessive pronoun ALWAYS undergoes cliticization (either to the whole N̄-phrase or to the head noun), then the presence of the "pseudo" associative ↓ in the examples of (5.2-2) is accounted for, for the rule of Like-Tone Marker Deletion will not delete the ↓ at the end of the head of the phrase if it is followed by only a weak word boundary.

Now consider the bisyllabic possessive pronouns *u↓nu*↑ 'your' (pl) and ↓*aỹị*↓ 'our'. Unlike the monosyllabic possessive pronouns, the bi-syllabic possessive pronouns never cliticize to the head noun. I therefore assume that they are separated from the phrases they modify by a strong word boundary,[19] so that the phrases *oce u↓nu*↓ 'your chairs' and *ite*↑ *u↓nu*↑ 'your pots' have the underlying representations shown below:

(5.2-7) a. oce↓ *##* u↓nu↑ b. ite↑ *##* u↓nu↑

No rule applies in (b), but (a) undergoes Like-Tone-Marker Deletion, which deletes the ↓ at the end of *oce*↓, creating the correct surface tone contour

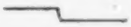
(5.2-8)



oce u↓nu↑ 'your chairs'

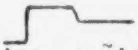
The pronoun *↓aỹị↓* 'our' is exceptional in that it is always preceded by a pitch drop, whatever the tone shape of the word which precedes it. Examples are given below with a head noun ending with a ↓ and a head noun ending with a ↑:

(5.2-9) a.



oce↓ aỹị↓ 'our chairs'

b.

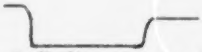


ị↑te ↓aỹị↓ 'our pots'

(*ite↑* 'pots')

(Notice that the ↑ at the end of *ite↑* 'pots' has been retracted before the ↓ at the beginning of *↓aỹị↓*.) The property of always being preceded by a pitch drop is characteristic not only of the possessive pronoun *↓aỹị↓* 'our', but also of the object pronoun *↓aỹị↓* 'us', as can be seen from the examples below, taken from Green and Igwe (1963):

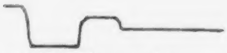
(5.2-10) a.



O↓ỹer̃e ya↑ ya↓ 'He gave it to him'

(from *o↓* + *ỹer̃e↑* + *ya↑* + *ya↓*)
'he' 'gave' 'it' 'it'
(ind.obj. (dir.obj.
form) form)

b.

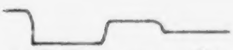


O↓ỹe↑r̃e↓ aỹị ya↓. 'He gave it to us.'

(*↓aỹị↓*)

'us'

c.



O↓ỹer̃e↑ ya↓ aỹị↓ 'He gave it to us'

(alternate word order)

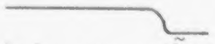
Notice that there is a drop in pitch before *↓aỹị↓* in both (b) and (c) even though the word which precedes *↓aỹị↓* would, in both instances, ordinarily end on a low tone level (as can be seen from example (a)). Since *↓aỹị↓* as a possessive or object pronoun is

ALWAYS preceded by a pitch drop, I assume that this pitch drop is part of its lexical representation.

6. Accounting for the Deletion of the Associative ↓ in Certain Cases

6.1 Internal ↓ Deletion: additional evidence for the binary structure of nominal phrases. When the second element of a nominal phrase consists of a high-toned syllabic segment plus two or more additional syllables, the associative ↓ fails to appear as expected. For example, there is no associative ↓ after the first syllable of the second constituent of the phrases below:

(6.1-1) a.

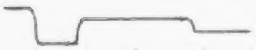


isi eɣu a↓h̃ụ↑ 'the head of that goat'

(from *isi↓* + ↓ + *eɣu a↓h̃ụ↑*)

'head' 'that goat'

b.



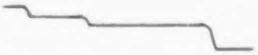
o↓tu↑ ezi o↓kwu↓ 'one true statement'

(from *o↓tu* + ↓ + *ezi okwu↓*)

'one' 'true statement'

Notice that it is not the case that the rule of Associative ↓-Insertion fails to apply when the second element of the phrase has three or more syllables; the associative ↓ will be present in phrases paralleling those of (6.1-1) if the second element of the phrase begins with a low-toned syllable, as in

(6.1-2) a.

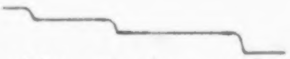


ọ↓dhụ↓ oke a↓h̃ụ↑ 'the tail of that rat'

(from *ọ↓dhụ↑* + ↓ + *o↑ke a↓h̃ụ↑*)

'tail' 'that rat'

b.



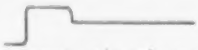
o↓tu n↓nukwu ụ↓lọ↑ 'one large house'

(from *o↓tu↑* + ↓ + *n↑nukwu u↓lọ↑*)

'one' 'large house'

Furthermore, the associative ↓ will be present even when the second element of the phrase begins with a high-toned syllabic segment if the construction is one of those in which the associative ↓ is not cliticized to the second element of the phrase. For example, there is an associative ↓ between the two elements of the phrase below:

(6.1-3)



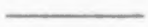
ọ↑gụ↓ akwụkwọ↓ 'book-reader'

(from *ọ↑gụ↓* + ↓ + *akwụkwọ↓*)

'reader' 'books'

The examples above show that the rule of Associative ↓-Insertion must apply in the normal way to nominal phrases whose second elements contain three or more syllables. Since that is the case, the absence of an associative ↓ in phrases like those of (6.1-1) must be the result of some subsequent rule which deletes the associative ↓ from phrases of this sort. In fact, in dialects of Igbo which contain nouns with the lexical tone contour H'H, there is direct evidence for such a rule, for the internal pitch drop is deleted from such a noun when it is the first element of a noun phrase which also contains some other element. For example, we find

(6.1-4) a.

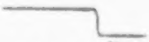


agụ ukwu↓ 'a large leopard'

(from *a↓gụ↓* + *ukwu↓*)

'leopard' 'large'

b.

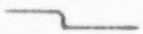


ego a↓hụ̃↑ 'that money'

(from *e↓go↓* + *a↓hụ̃↑*)

'money' 'that'

c.

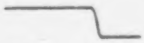


ego↓ atọ↓ 'three shillings'

(from *e↓go↓* + *a↑tọ↓*)

'three'

(6.1-4) d.

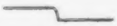


ọnụ ụ↓lọ↑ 'doorway'

(from *ọ↓nụ↓ + ↓ + ụ↓lọ↑*)

'mouth' 'house'

e.

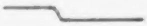


ọgụ↓ ji↓ 'twenty yams'

(from *ọ↓gụ↓ + ↓ + ji↓*)

'twenty' 'yams'

f.



ego↓ Ekwe↓ 'Ekwe's money'

(from *e↓go↓ + ↓ + Ekwe↓*)

'money'

I propose to account for the loss of the internal pitch drop of the first word of each of the phrases above by means of the rule below:

(6.1-5) Internal ↓ Deletion

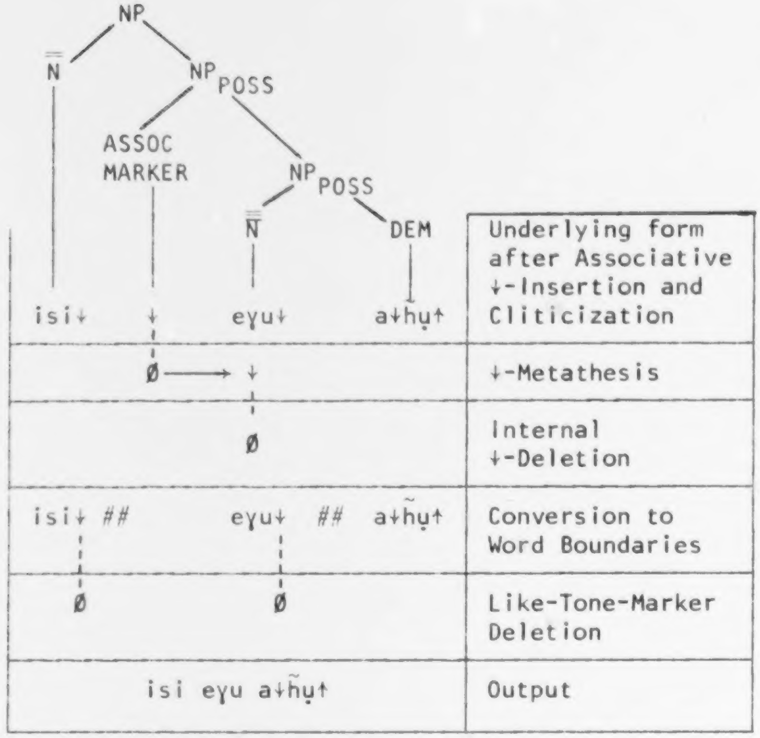
$_{[+N]}[[+\text{syll}]\ \downarrow\ \sigma\ \downarrow\ \ldots]$

s.d. 1 2 3 4 5, where 5 ≠ ∅

s.c. 2 > ∅

This rule deletes a pitch drop which follows a syllabic segment at the beginning of a nominal phrase which contains three or more syllables all together. If the rule is ordered after ↓-Metathesis (4-13), then it will also account for the absence of an associative ↓ in the phrases of (6.1-1). For example, the phrase *isi eɣu a↓h̃ụ↑* has the derivation shown below:

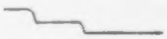
(6.1-6)



isi↓ ↓ eɣu↓ a↓hụ↑	Underlying form after Associative ↓-Insertion and Cliticization
∅ → ↓	↓-Metathesis
∅	Internal ↓-Deletion
isi↓ ## eɣu↓ ## a↓h̃ụ↑	Conversion to Word Boundaries
∅ ∅	Like-Tone-Marker Deletion
isi eɣu a↓h̃ụ↑	Output

There are three parts of the structural description of the rule of Internal ↓ Deletion which need justification. First is the requirement that the syllable which follows the target ↓ must be high-toned (i.e., must be followed by a ↓ rather than a ↑.) This is to prevent the deletion of the ↓ which follows the initial syllabic segment of a phrase like the following:

(6.1-7)



ụ↓lọ↓ Ekwe↓ 'Ekwe's house'

(from *ụ↓lọ↑* + ↓ + *Ekwe↓*

'house'

Notice that phrases like these establish the ordering of Internal ↓ Deletion before Streamlining, since once the ↓ at the end of *ụ↓lọ↑* has been deleted by Streamlining, the structural description of Internal ↓ Deletion is met. It is generally the case that rules whose domain is specified in terms of labelled bracketing apply before those whose domain is specified in terms of word boundaries.

That brings us to the second aspect of the structural description of the rule of Internal ↓ Deletion which needs justification, and that is the fact that the domain of the rule is specified in terms of labelled bracketing. One reason for defining the domain of the rule in these terms is that it is necessary to prevent it from applying to verbs; for example, the rule does not apply to the verb *a↓tụ↓bha↑* 'didn't throw out', which meets its structural description in every way except that it is not a nominal phrase. A second reason is that there is apparently no way to single out the environments to which this rule applies using word-boundary structure alone. For example, suppose that the phrases of (6.1-4) had the word-boundary structure:

(6.1-8) *## ... # ... ##*

That is, suppose that the two elements of the phrase are separated by a single word-boundary only. Given this hypothesis, we might then propose, further, that the rule of Internal ↓-Deletion applies to a domain delineated by double word boundaries; in other words, we might try to state the rule in the following way:

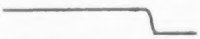
(6.1-9) *##* [+syll] ↓ σ ... *##*

s.d. 1 2 3 4 5 6, where 5 ≠ 0

s.c. Delete 3.

The problem with this version of the rule is that it is impossible to apply it correctly to a phrase like

(6.1-10)



elu oce a↓h̃ụ↑ 'the top of that chair'

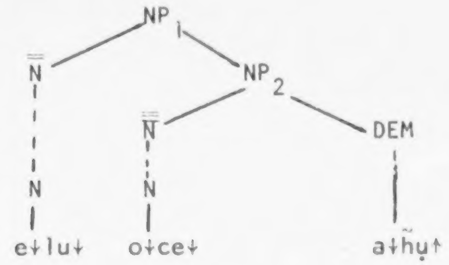
(from *e↓lu↓* + ↓ + *oce↓* + *a↓h̃ụ↑*)

'top' 'chair' 'that'

in which both the internal ↓ of *e↓lu↓* and the associative ↓ which would otherwise appear after the first syllable of *oce↓* are deleted. Thus if we assume that there is a double word-boundary between *e↓lu↓* and *o↓ce↓*, then rule (6.1-9) will correctly delete the associative ↓ from *o↓ce↓*, but will not delete the internal ↓ from *e↓lu↓*. If, on the other hand, we assume that there is a single word boundary between *e↓lu↓* and *o↓ce↓*, then the rule will delete the internal ↓ of *e↓lu↓*, but will not delete the associative ↓ from *o↓ce↓*. Clearly, the rule of (6.1-9) cannot apply correctly to the phrase of (6.1-10) whatever word-boundary structure we assign to that phrase.

By defining the domain of the rule in terms of labelled bracketing, as in (6.1-5), we obtain the correct output for this phrase. Thus, after the application of ↓-Cliticization and ↓-Metathesis, the phrase has the following structure

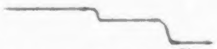
(6.1-11)



The tree diagram above shows that both *e↓lu↓* and *o↓ce↓* stand at the beginning of nominal phrases (NP_1 and NP_2, respectively) which contain three or more syllables altogether. Thus, both NP_1 and NP_2 meet the structural description of the rule as stated in (6.1-5), and the internal ↓'s of *e↓lu↓* and *o↓ce↓* are both deleted, as they should be.

The third part of the structural description of the rule of Internal Drop Deletion which needs justification is the requirement that the ↓ which is deleted must follow the first syllable of the phrase.[20] This requirement is necessary to prevent the rule from deleting the internal ↓ from *e↓γu↓* and *u↓te↓* in

(6.1-12) a.

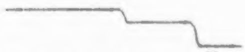


isi e↓γu a↓h̃ụ↑ 'that goat-head'

(from *isi e↓γu↓* + *a↓h̃ụ↑*)

'goat-head' 'that'

b.



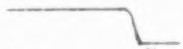
obodobo u↓te a↓h̃ụ↑ 'that wide mat'

(from *obodobo u↓te↓* + *a↓h̃ụ↑*

'wide mat' 'that'

Phrase (a) above contrasts tonally with the phonologically identical

(6.1-13)



isi eγu a↓h̃ụ↑ 'the head of that goat'

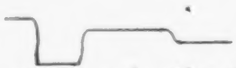
(from *isi↓* + ↓ + *eγu a↓h̃ụ↑*)[21]

'head' 'that goat'

in which *eɣu↓* is the first element of a nominal phrase, and the associative ↓ which comes after its first syllable in underlying representation has been deleted by Internal ↓ Deletion.

The rule of Internal ↓ Deletion provides independent evidence for some of the assumptions we have made about the internal structure of the noun phrase in Igbo. In particular, the fact that this rule has apparently applied to delete the associative ↓ which would otherwise appear after the first syllable of *ezi↓* 'true' in the phrases below supports our hypothesis that an adjective forms a constituent with the element it modifies:

(6.1-14) a.

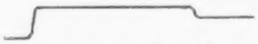


o↓tu↑ ezi o↓kwu↓ 'one true statement'

(from *o↓tu↑* + ↓ + *ezi↓* + ↓ + *okwu↓*)

'one' 'true' 'statement'

b.



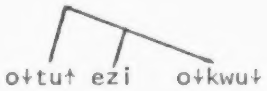
n↑nukwu ezi o↓kwu↓ 'a great truth'

(from *n↑nukwu↓* + ↓ + *ezi↓* + ↓ + *okwu↓*)

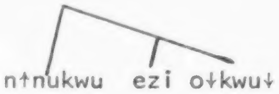
'great' 'true' 'statement'

In other words, the phrases of (6.1-14) must have the structures

(6.1-15) a.

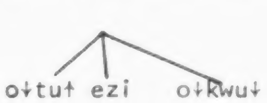


b.

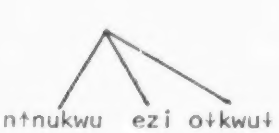


and not the flat, multi-limbed structures

(6.1-16) a.



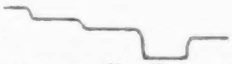
b.



6.2 Some constructions which do not undergo Internal ↓ Deletion.

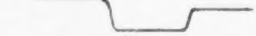
There are some sorts of nominal phrases to which the rule of Internal ↓ Deletion does not apply. For example, the internal ↓'s of the nouns *I↓gwe↓* (person's name) and *e↓go↓* are not deleted in the phrases below:

(6.2-1) a.



I↓gwe↓ w̃u↓ỹe↑ m↓ 'Igwe, my wife'
(from *I↓gwe↓* + ↓ + *w̃u↓ye↑* 'wife' + *m↓* 'my')

(6.2-1) b.

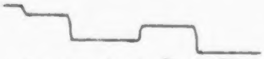


I↓gwe m↓h̃ụrụ↑ eci↓ 'Igwe, whom I saw yesterday'

(from *I↓gwe↓* + *m↓* + *h̃ụr̃ụ↑* + *eci↓*)

'I' 'saw' 'yesterday'

c.



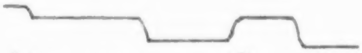
e↓go↓ akụ↑ w̃a↓aỹị↑ 'the money for the bride-price'

(from *e↓go↓* + *akụ↑* + *w̃a↓aỹị↑*

'money' 'price' 'woman'

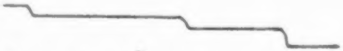
In addition, the rule does not apply to an infinitive phrase in a NP-position, as inthe examples below:

(6.2-2) a.



ị↓ta anụ↓ na e↑ỹe n↓dhụ↑. 'To eat meat gives health.'

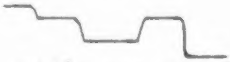
b.



A↓maɣị ih̃ye↓ wụ ọ↓rya↑. 'Stupidity (lit. not to know things) is a disease.'

Nor does it necessarily apply in conjoined NP's such as

(6.2-3)



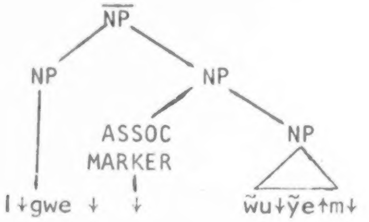
ọ↓jị↓ na↑ o↓se↑ 'kola nuts and pepper'

(from *ọ↓jị↓* + *na↑* + *o↓se↑*)

'kola nuts''and''pepper'

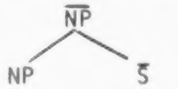
What these exceptions to Internal ↓ Deletion have in common is that in all of them the structural description of the rule is met only within the "highest" level nominal phrase, hte $\overline{\text{NP}}$-phrase. For example, if we assume the following structure for (6.2-1.a):

(6.2-4)

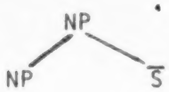


then it is only at the $\overline{NP}$ level that we find a nominal phrase which meets the structural description of the rule of Internal ↓ Deletion. Thus the failure of the rule to apply to phrases of this sort suggests that its domain is limited to nominal phrases at or below the $\overline{NP}$-level. This hypothesis makes certain predictions which are borne out in fact. For example, given the contrasting structures which we have assumed for restrictive and non-restrictive relative clauses, shown below

(6.2-5) a. Non-restrictives

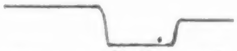


b. Restrictives



we predict that Internal ↓ Deletion will delete the Internal ↓ of the bi-syllabic head of a restrictive relative clause, but not that of the bi-syllabic head of a non-restrictive clause. This prediction is borne out by the contrast between the non-restrictive relative of (6.2-1b) (to which Internal ↓ Deletion does not apply) and the restrictive relative below, to which it does apply, deleting the internal ↓ of *e↓go↓*:

(6.2-6)



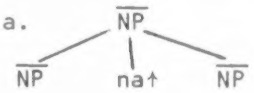
ego m↓ỹer̃e↑ gị↓ 'the money I gave you'

(from *e↓go↓* + *m* + *ỹer̃e↑* + *gi↓*)

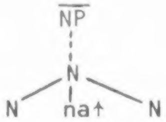
'money' 'I' 'gave' 'you'

Now consider the conjoined noun phrases of (6.2-3). As we observed in section (2-5) above, conjunction may take place on at least two levels in Igbo, the "highest" level and the lowest (lexical) level. Thus the phrase of (6.2-3) should be structurally ambiguous between the two structures shown below:

(6.2-7) a.

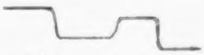


b.



If it is true that the rule of Internal ↓ Deletion is restricted to nominal phrases at the NP-level or lower, then it should apply to the structure of (b), but not to that of (a). This prediction of the analysis is fulfilled, since the phrase of (6.2-3) may be pronounced either with the tone contour shown there (in which case Internal ↓ Deletion has not applied) or with the tone contour below, in which Internal ↓ Deletion HAS applied, deleting the internal ↓ of *ọ↓jị↓*:

(6.2-8)

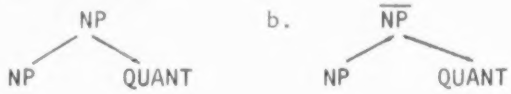


ọjị↓ na↑ o↓se↑

My informant finds these two pronunciations to be equally acceptable, and interchangeable.

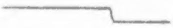
Having found substantial evidence that the rule of Internal ↓ Deletion does not apply at the $\overline{\text{NP}}$-level, we may now use that fact as evidence for the structure of nominal phrases whose structure might otherwise be in doubt. In particular, we may use this restriction on the rule of Internal ↓ Deletion to determine which of the following structures should be assigned to a noun phrase which is modified by a quantifier:

(6.2-9) a. b.



If (a) is the correct structure, then the internal ↓ of the noun *e↓go↓* 'money' should be deleted by Internal ↓ Deletion when that noun is modified by the quantifier *ni↓ile↓* 'all', producing the phrase

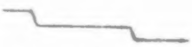
(6.2-10)



ego ni↓ile↓ 'all the money'

If, on the other hand, (b) is the correct structure, then Internal ↓ Deletion should not apply, and the phrase of (6.2-10) should have the tone contour shown below:

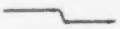
(6.2-11)



e↓go ni↓ile↓ 'all the money'

While my informant does not find the tone contour of (6.2-11) altogether unacceptable, he much prefers that of (6.2-10). Thus I conclude that (6.2-9a), and not (6.2-9b), is the correct structure for phrases of this sort.

6.3 The rule of Sandwiched ↓ Deletion. Most speakers of Igbo do not apply the rule of Internal ↓ Deletion to a nominal phrase which consists of a head noun plus a monosyllabic possessive pronoun. Where we would expect to find

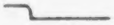
(6.3-1) 

e↓go↓ gị↓ 'your money'

(from *e↓go↓* + *gị↓*)

'money' 'your'

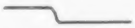
these speakers say, instead,

(6.3-2) 

e↓go gị↓

That is, they delete the ↓ at the END of *e↓go↓* rather than its internal ↓. (Other speakers use the pronunciation of (6.3-1) which our rules predict.)

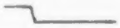
Notice that the tone contour of (6.3-2) cannot be derived simply by retracting the ↓ at the end of *e↓go↓* one syllable when it is followed by a monosyllabic possessive pronoun, because the hypothetical rule of ↓-Retraction which would create this tone change would have to apply also to a phrase like

(6.3-3) 

eγu↓ gị↓ 'your goat'

(from *eγu↓* +*gị↓*) 'goat' 'your'

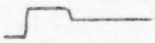
producing the ungrammatical tone contour

(6.3-4) * 

e↓γu gị↓ 'your goat'

What is needed to account for the tone contour of (6.3-2) is a rule to delete the ↓ at the end of *e↓go↓* when this noun is followed by a monosyllabic possessive pronoun such as *gị↓*. This requirement is satisfied by an independently-motivated rule which is needed to account for the fact that the nouns *mi↓r̃i↓* 'water' and *mmụ↓ọ↓* 'spirit' lose their internal ↓'s when an associative ↓ is adjoined to the beginning of the noun, as in the examples

(6.3-5) a.

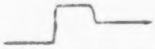


ụ↑dọ↓ mir̃i↓ 'scarcity of water'

(from *ụ↑dọ↓* + ↓ + *mi↓r̃i↓*)

'scarcity' 'water'

b.



ala↑ m↓mụọ↓ 'land of spirits'

(from *ala↑* + ↓ + *mmụ↓ọ↓*)

'land' 'spirits'

I propose to state the rule for this tone change in the following way:

(6.3-6) Sandwiched ↓-Deletion.

$$_{[+N]}[([+\text{syll}])\ \downarrow\ \sigma\ \downarrow\ \sigma\ \downarrow\ \ldots\ ]$$

s.d. 1 2 3 4 5 6 7

s.c. Delete 4.

This rule deletes a ↓ which lies between two ↓'s inside a nominal phrase. For example, it deletes the internal ↓ of *mi↓r̃i↓* when an associative ↓ has cliticized to it to produce the intermediate for *↓mi↓r̃i↓*.[23] Similarly, it deletes the internal ↓ of *mmụ↓ọ↓* when an associative ↓ cliticizes to it and is transposed with its first syllable to produce the intermediate form *m↓mụ↓ọ↓*. Finally, it also applies to the underlying form *e↓go↓ gị↓* 'your money', deleting the lexical ↓ at the end of the head noun, and producing the output tone contour of (6.3-2). Notice that the application of Sandwiched ↓ Deletion destroys the environment of Internal ↓ Deletion, so that the internal ↓ of *e↓go gị↓* is not deleted.

Because the rules of Internal ↓ Deletion and Sandwiched ↓ Deletion are so similar in their structural descriptions, and because of the disjunctive ordering between them, it is tempting to try to collapse them, in the following way:

(6.3-7) Internal ↓ Deletion

$$_{[N]}[(([+\text{syll}])\ C_0)\ [+\text{syll}]\ \downarrow\ \sigma\ \downarrow\ \ldots\ ]$$

s.d. 1 2 3 4 5 6

s.c. Delete 3.

Condition: If 6 ≠ Ø, then 1 is obligatory.

Whether or not these two rules should be collapsed in this manner depends on whether or not we wish to allow conditions of this sort on phonological rules.

There are several possible ways of accounting for the alternative tone contour *ego↓ gị↓*, which is used by some speakers for the phrase of (6.3-1). The simplest of these is to assume that in the grammar employed by these speakers, the rule of Internal ↓ Deletion is ordered before Sandwiched ↓ Deletion. When Internal ↓ Deletion deletes the first ↓ of *e↓go↓ gị↓* in these dialects, it destroys the environment of Sandwiched ↓ Deletion, and that rule cannot apply. It should be possible to find empirical evidence for or against this proposal, for speakers who apply Internal ↓ Deletion before Sandwiched ↓ Deletion should also say *ala mmụ↓ọ↓* 'land of spirits' instead of *ala m↓muo↓*. Unfortunately, I do not know whether or not this prediction of the analysis is borne out in fact.

6.4 Associative ↓ Deletion. The ↓-deletion rules which I have introduced so far are the rules of Internal ↓ Deletion and Sandwiched ↓ Deletion, repeated below from (6.1-5) and (6.3-6):

(6.4-1) a. Internal ↓ Deletion.

$$_{[+N]}[[+\text{syll}] \downarrow \sigma \downarrow \ldots]$$

s.d. 1 2 3 4 5, where 5 ≠ 0

s.c. Delete 2.

b. Sandwiched ↓ Deletion.

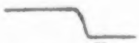
$$_{[+N]}[([+\text{syll}]) \downarrow \sigma \downarrow \sigma \downarrow \ldots]$$

s.d. 1 2 3 4 5 6 7

s.c. Delete 4.

The first of these rules accounts for the loss of the internal ↓ of *e↓go↓* in

(6.4-2)

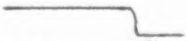


ego a↓h̃ụ↑ 'that money'

(repeated from (6.1-4b))

and for the fact that there is no associative ↓ after the first syllable of the possessive NP in

(6.4-3)

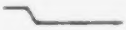


isi eɣu a↓h̃ụ↑ 'the head of that goat'

(repeated from (6.1-1a))

The second rule accounts for the deletion of the ↓ at the end of the head noun in phrases like

(6.4-5)

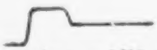


e↓go gị↓ 'your money'

(repeated from (6.3-2))

and for the deletion of the internal ↓ of a noun like *mi↓r̃i↓* 'water' when it acquires an initial associative ↓ in phrases such as

(6.4-6)



ụ↑dọ↓ mir̃i↑ 'a scarcity of water'

(repeated from (6.3-5a))

Note that, for speakers who use the tone contour of (6.4-5), Sandwiched ↓ Deletion must be ordered before Internal ↓ Deletion.

In this section, I will argue for a third ↓-deletion rule, which I will call Associative ↓ Deletion, and which will be stated as follows:

(6.4-7) Associative ↓ Deletion.

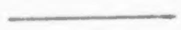
[+N][↓[+syll] σ σ ... ↓ ...]

s.d. 1 2 3 4 5 6 7

s.c. Delete 1.

The rule of Associative ↓ Deletion is needed to account for the fact that there is no associative ↓ after the first syllable of a three-syllable noun with the lexical tone contour of *akwụkwọ↓* in phrases like

(6.4-8)

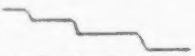


isi akwụkwọ↓ 'chapter of a book'

(from *isi↓* + ↓ + *akwụkwọ↓*)

'chapter' 'book'

The phrase of (6.4-7) contrasts in this respect with the parallel phrase

(6.4-9) 

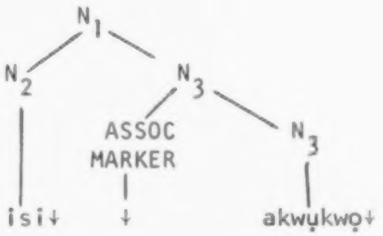
ụ↓lọ↓̲ ọkụ↓kọ↑ 'chicken-house'

(from *ụ↓lọ↑* + ↓ + *ọ↑kụ↓kọ↑*)

'house' 'chicken'

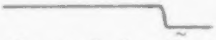
which does have an associative ↓ at the boundary between its two constituents. This example shows that the rule of Associative ↓ Insertion applies in the normal way to nominal phrases which begin with lexical items which have three or more syllables. Thus Associative ↓ Insertion must apply to the phrase of (6.4-8), inserting an associative ↓ between its two constituents. The associative ↓ then cliticizes to the second constituent, creating the intermediate structure

(6.4-10)



Finally, the rule of Associative ↓ Deletion (6.4-7) applies, deleting the associative ↓ from the beginning of the "higher" N_3.

Like the rule of Internal ↓ Deletion, the rule of Associative ↓ Insertion may apply to a lexical category (as in (6.4-10)) or to a higher-than-lexical category. For example, this rule is responsible for the deletion of the associative ↓ from the phrase

(6.4-11) 

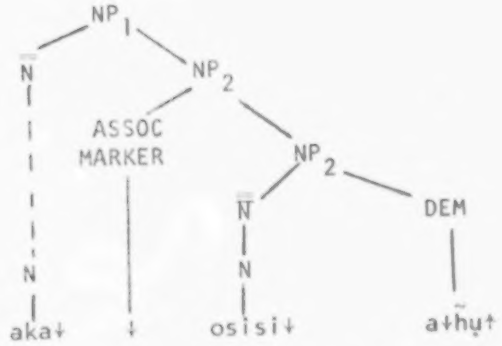
aka osisi a↓h̃ụ↑ 'a branch of that tree'

(from *aka↓* + ↓ + *osisi a↓h̃ụ↑*)

'branch' 'that tree'

whose underlying structure (after ↓-Cliticization) is shown below:

(6.4-12)

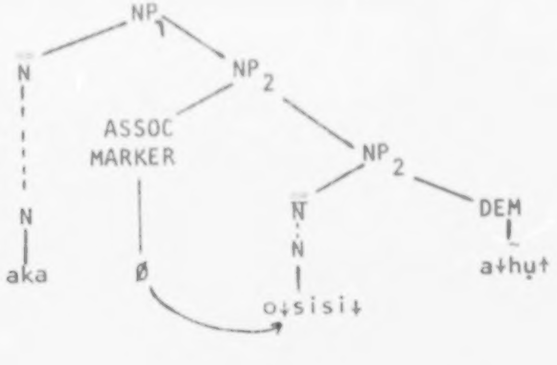


The rule of Associative ↓ Deletion applies to the higher NP_2 in this phrase, deleting the associative ↓ which is its first element.

The reader may have noticed that in the analysis which I have proposed here, there are two distinct rules, Internal ↓ Deletion and Associative ↓ Deletion, which act to prevent the occurrence of a ↓ after the first syllable of a nominal constituent which contains three or more syllables in all. The first rule, Internal ↓ Deletion, deletes the (circled) associative ↓ from an underlying form like $[_{NP}$ isi↓$[_{NP}$e↓⃝γu a↓hu $_{NP}]_{NP}]$ 'the head of that goat.' The second rule Associative ↓ Deletion, deletes the associative ↓ from an underlying form like $_{NP}[$*aka↓*$_{NP}[$ ↓⃝*osisi a↓hụ̃↑*$_{NP}]_{NP}]$. Note that if the associative ↓ were not deleted from the phrase, ↓-Metathesis would apply, creating the surface contour **aka o↓sisi a↓hụ̃↑*.

While it is somewhat surprising that there should be two rules in the grammar with so much the same effect, there are several reasons for believing that these two cases do indeed require two distinct rules. Thus, suppose that, contrary to the analysis which I have proposed here, we were to allow the rule of ↓-Metathesis to apply to the underlying structure (6.4-12) to create the intermediate level structure which is shown below:

(6.4-13)



Now notice that NP_2 (= *o↓sisi a↓hụ̃↑*) does not meet the structural description of the rule of Internal ↓ Deletion as stated in (6.4-1a), because its second ↓ is in the wrong position. Thus, if we wanted to use the rule of Internal ↓ Deletion to account for the deletion of the associative ↓ from this phrase, then that rule would have to be re-stated so as to make the position of the second ↓ irrelevant. In other words, the rule would have to be re-stated as follows:

(6.4-14) $_{[+N]}[[+\mathrm{syll}]\,,\!\downarrow\ \sigma\ \ldots\ \downarrow\ \ldots\ ]$

s.d. 1 2 3 4 5 6

s.c. Delete 2.

Condition: 4 and 6 may not both equal 0.

There are two reasons for believing that this approach is not the right one. One is the oddity of the condition on rule (6.4-14). The other is that this statement of the rule gives incorrect results in certain cases. For example, it would incorrectly delete the ↓ after the first syllable of noun-possessive combinations like *e↓go gị↓* (6.4-5). In addition, it would incorrectly delete the ↓ after the first syllable of nouns with the lexical tone shape of *ŋ↓ghadha↓* 'sword'. (Note that there are no nouns with the lexical tone shape [[+syll]↓ CV↓ ...], which would violate the rule of Internal ↓ Deletion as it was stated in (6.4-1a)). I therefore conclude that the rule of Internal ↓ Deletion is correctly stated in (6.4-1a), and that an independent rule, the rule of Associative ↓ Deletion, is needed to account for the deletion of the associative ↓ in phrases like (6.4-13).

I can only speculate as to why there should be two distinct rules in the grammar of Igbo which both act to prevent the occurrence of an associative ↓ after the first syllable of a nominal phrase with three or more syllables in all. However, it is possible that there is a phonetic basis for these rules, for Lehiste (1970) points out that there are languages which tend to maintain a constant duration for a word, so that in words with a greater number of syllables, each syllable is shorter in duration than it would be if it were part of a word with fewer syllables. If, in a language of this sort, it were the syllables at the BEGINNING of a longer word which were "speeded up" most markedly, then there would be a tendency to "lose" small pitch changes which would otherwise be found in a long word, for a small pitch change between syllables which are very short in duration would be difficult to hear. Thus we would expect such a language to develop rules like the Igbo rules of Internal ↓ Deletion and Associative ↓ Deletion. Unfortunately I have no data on the duration of syllables in Igbo to either support or disprove the hypothesis that this is how these rules arose in Igbo.

7. A Summary of the Analysis

The rules which have been motivated here are repeated below, in the order in which they must apply:

(7-1) Syntactic Rules

a. Associative ↓ Insertion (repeated from (3-13))

$$[[\ldots]_{[+N]}[\ldots]_{[-V]}]$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

b. ↓-Cliticization (repeated from (4-9))

$$[[\ldots]_{\begin{bmatrix}\langle +N\rangle_a \\ \langle -AGENTIVE\rangle_b\end{bmatrix}} [\downarrow] \begin{bmatrix}+N \\ \langle +PROPER\rangle_c \\ \langle -POSSESSIVE\rangle_d\end{bmatrix}[\ldots]]$$

s.d. 1 2 3

s.c. Chomsky-adjoin 2 to 3.

Condition: a ⊃ b and c ⊃ d.

(7.2) Phonological Rules Whose Domains are Defined in Terms of Labelled Bracketing

a. Associative ↓ Deletion (repeated from (6.4-7))

$${}_{[+N]}[\ \downarrow [+syll]\ \sigma\ \sigma\ \ldots\ \downarrow\ \ldots\ ]$$

s.d. 1 2 3 4 5 6 7

s.c. Delete 1.

b. ↓-Metathesis (repeated from (4-13))

$${}_{[+N]}[\ \downarrow [+syll]\ \ldots \downarrow \ldots\ ]$$

s.d. 1 2 3 4 5

s.c. Transpose 1 and 2.

c. Sandwiched ↓ Deletion (repeated from (6.3-6))

$${}_{[+N]}[([+syll])\ \downarrow\ \sigma\ \downarrow\ \sigma\ \downarrow]$$

s.d. 1 2 3 4 5 6

s.c. Delete 4.

(7.2) d. Internal ↓ Deletion (repeated from (6.1-5))

$_{[+N]}[[+\text{syll}] \downarrow \sigma \downarrow \ldots]$

s.d. 1 2 3 4 5, where 5 ≠ ∅.

s.c. Delete 2.

Condition: This rule does not apply to the highest level nominal phrase, NP.

(7-3) Phonological Rules Whose Domains are Specified in Terms of Phonological Boundaries.

a. Syllable-Lengthening (repeated from Chap. II, (3.3-8))

[+syll][+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Make 1 long.

b. Syllable-Shortening (repeated from Chap. II, (3.3-9))

[+syll] (#) (#) [+syll]

s.d. 1 2 3 4

s.c. Make 1 short.

c. Right Streamlining (repeated from (1-2.a))

↓ (#) ([+syll]) [+tone]

s.d. 1 2 3 4

s.c. Delete 4.

d. ↑-Retraction (repeated from (1-5))

σ σ ↑ (#) (#) ↓

s.d. 1 2 3 4 5 6

s.c. Transpose 2 and 3.

Condition: If 4 and 5 are both present, then 2 is not long.

(7.3) e. Left Streamlining (repeated from (1-2b))

σ [+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Delete 2.

Condition: If 3 and 4 are both present, then 1 is not long.

f. Syllabic-Nasal Raising (repeated from (1-8.b))

$\#\# \; [+\text{tone}] \; \begin{bmatrix}+\text{syll}\\ +\text{nas}\end{bmatrix} \; [+\text{nas}]$

s.d. 1 2 3 4

s.c. Transpose 2 and 3.

g. Phrase-final-↓ Deletion (repeated from Chapter II)

$\downarrow \rightarrow \emptyset \; / \; \_\_\_\_ \; \$$

Condition: optional.

h. Like-Tone-Marker Deletion. (repeated from Chapter II)

$\begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} \; <\#\#> \; \ldots \; \begin{bmatrix}+\text{tone}\\ <+\text{fall}>\end{bmatrix} \; \ldots \; \$\$$

s.d. 1 2 3 4 5 6

s.c. 1 > Ø

i. ↓-Reduction. (repeated from (1-4))

$\downarrow \; \ldots \; \downarrow \; \ldots \; \$\$$

s.d. 1 2 3 4 5

s.c. Reduce the magnitude of 1 by two thirds.

Of the rules which have been introduced in this chapter, the first rule, the rule of Associative ↓ Insertion, introduces the associative morpheme [↓] between the two constituents of a phrase if the first constituent is nominal (i.e. if it is a noun or adjective or a phrase whose head is a noun or adjective) and if the second constituent is non-verbal (i.e. it is not a clause, verb phrase, adjective, quantifier, demonstrative, or possessive pronoun).

The rule of ↓-Cliticization attaches the associative ↓ to the constituent which follows it. This rule does not apply if the constituent which follows the ↓ is a proper noun possessive, or if the constituent which precedes it is an agentive noun.

If ↓-Cliticization HAS applied, and if the constituent to which the ↓ is attached begins with a high-toned syllabic segment, then one of two rules applies: either (i) Associative ↓ Deletion, which deletes an initial ↓ from a nominal phrase whose first internal tone marker is a ↓ with three or more syllables before it, or (ii) ↓-Metathesis, which transposes the ↓ with the initial syllable of the phrase.[24] The first rule accounts for the fact that there is no associative ↓ in the phrase *isi akwụkwọ↓* 'chapter of a book', and the second accounts for the surface position of the associative ↓ in the phrase isi *e↓ɣu↓* 'the head of a goat'.

The rule of Sandwiched↓ Deletion (7-2c) is responsible for the loss of the internal ↓ of *mi↓r̃i↓* 'water' in the phrase *ụ↑dọ ↓mir̃i↓* 'a scarcity of water', where an associative ↓ has been adjoined to *mi↓r̃i↓*. This rule also accounts for the loss of the ↓ at the end of the head noun in phrases like *e↓go gị↓* 'your money' (from *e↓go↓* 'money' + *gị↓* 'your') in most dialects of Igbo.

The rule of Internal ↓ Deletion (7-2d) deletes the internal ↓ of a word with the tone shape of *e↓go↓* when it stands at the beginning of a nominal phrase which also contains other material, as in *ego a↓h̃ụ↑* 'that money'.

The rules which have been introduced in this chapter account for the distribution and position of the associative ↓ in all the different sorts of nominal phrases which I am aware of in Igbo.

FOOTNOTES TO CHAPTER VI

[1] The second term of this rule may not, of course, contain any tone markers. I have not included this condition in the statement of the rule itself, because it is generally the case that the sphere of operation of a tone rule is limited to the string which includes the target tone marker and the tone markers which immediately precede and follow it.

[2] Probably both of these examples are compounds rather than nouns modified by possessive noun phrases. This distinction is irrelevant to our present purposes, because the tonal properties of the two constructions are identical.

[3] Notice that I am assuming the presence of an associative ↓ between the numeral *o↓tu↑* and the adjective *obodobo↓*, though there is no ↓ at this boundary in the surface form. It is generally the case that the associative ↓ does not show up in the surface form when the constituent which follows it begins with a high-toned syllabic segment and contains three or more syllables altogether. This fact will be accounted for in section 6 below.

[4] Notice that there appears to be an associative ↓ between *eɣu↓* and *a↑tọ↓* in this example, but that I have not included one in the underlying form. The "pseudo" associative ↓ which appears before a cardinal numeral under certain circumstances will be accounted for in section 5 below.

[5] There are some restrictions on noun phrases of this sort; in particular, it is not possible to place a demonstrative after a possessive noun phrase which itself ends with a demonstrative. Thus it is not possible to say, for example,

(i) *akwụkwọ↓ w̃o↓ke↑ a↓h̃ụ↑ a↓h̃ụ↑ 'that book of that man's'

'book' 'man' 'that''that'

The ill-formedness of examples like these suggests that there is a surface-level constraint against a sequence of two demonstratives in a row. In addition, there is a certain semantic oddity which is present even in the English translation.

[6] The pitch drop between *akwụkwọ↓* and *gị↓* in this example is a "pseudo" associative ↓ and not a real one. This pitch drop will be accounted for in section 5 below.

[7] Notice that the modifying adjective goes outside the $\bar{N}$-phrase, not between ọŋụ and *mmaỹa*, as it would do if *mmaỹa* were a possessive

modifier of ọŋụ. (cf. (2.1-8)). Thus it is clear that the construction ọŋụ *mmaỹa* 'drinker of wine' has a different syntactic structure from the construction which is made up of a noun plus possessive modifier. However, I do not know what sort of evidence could be produced to show that phrases like ọŋụ *mmaỹa* are $\bar{N}$-phrases rather than compounds of a special sort; nor do I have any real evidence for analyzing the noun phrases of (2.2-5) below as a head noun plus complement rather than as a head noun plus appositive with a structure like that of the noun phrase *my wife Igwe*.

[8] Appositional noun phrases with *ŋke*↑ 'thing' and *ndị*↓ 'things' are frequently used to specify singularity or plurality, so that we find, for example,

(ii) a. eɣ̣u↓ ŋke↓ a↑ 'this goat'

b. eɣu ndị↓ a↑ 'these goats'

Sometimes a demonstrative or possessive is encased in an appositional noun phrase for structural reasons, as will be shown below.

[9] For the sake of simplicity, I have left out the associative ↓'s which appear in this phrase.

[10] The fact that it is necessary to mention the class of prenominal adjectives in the structural description of rule (3-4) constitutes the stronger argument against the rule, because it is possible to find explanations for the failure of the rule to insert an associative ↓ between the indirect and direct objects of a relative clause or between the head NP and the subject of a relative clause. Thus the former fact might be accounted for by means of the Principle of Strict Cyclicity, and the latter by the Tensed-S Condition. These constraints (from Chomsky (1973)) are stated below:

(iii) a. The Strict Cyclicity Principle.

No rule can apply to a domain dominated by a cyclic node A in such a way as to affect solely a proper subdomain of A dominated by a node B which is also a cyclic node.

b. The Tensed-S Condition.

No rule can involve X, Y in the structure $\ldots X \ldots [_{\alpha} \ldots Y \ldots] \ldots$ where α is a tensed sentence.

[11] In addition, the associative ↓ is found between a measure phrase and its object, as in the phrase

(iv) i↑ko m↓may̌a↓ 'a cup of wine'

(repeated from (3-1g)

and I assume that it also appears between the two elements of a phrase which consists of a noun and a modifying NP, though I have no evidence that this is the case, since the one example I have of this construction (*oỹe o↓bi↑ọjọ↓ọ↓*, 'a wicked person' (literally, 'someone of bad heart')) has a lexical tone shape such that the associative ↓ is not noticeable.

I have not included these examples in the list of (3-9) because I am unsure of their exact structure. Even so, it is clear that they satisfy the structural description of the rule of Associative ↓-Insertion as it is ultimately stated in (3-13).

[12] Jackendoff (1977) has proposed an alternative feature system which splits the syntactic categories into natural classes along different lines. In Chomsky's system, the categories A and V share a common feature, but N and V do not; in Jackendoff's system it is the categories N and V which share a common feature and N and A which do not. I have chosen Chomsky's system over Jackendoff's because, as will be shown below, it is the categories V and A which act as a natural class with respect to the rule of Associative ↓-Insertion in Igbo.

[13] Presumably there are also features which distinguish between adjectives and numerals.

[14] The facts with regard to demonstratives and cardinal numerals are somewhat complex, however, and will require additional discussion below.

[15] The Tagalog facts given here are taken from Schachter and Otanes (1972)

[16] The Persian facts given here are taken from Bing (1976).

[17] One would hope, of course, to find some principled reason why the rule of ↓-Cliticization does not apply to these two constructions. Unfortunately, I have none to propose at this time.

[18] In the form in which it is given here, the rule of ↓-Cliticization adjoins the associative ↓ to the whole second constituent of the nominal phrase. For example, in a phrase consisting of two NP's in apposition, rule (4-9) adjoins the ↓ to the second NP. However, this feature of the rule is arbitrarily chosen; I do not have any evidence that the ↓ cliticizes to the whole NP rather than to just the first word of it (which would be a numeral, adjective, or noun).

[19] Monosyllabic items are, in general, more likely to act as clitics, and more likely to be separated from adjacent sister elements by only a single word boundary. See the discussion of the boundary conventions in Chapter VIII.

[20] Some speakers allow an additional "[+syll]↑C" before the ↓ which is deleted by this rule. For these speakers, words like *ọ↑dụ↓dụ↓* 'spider' and *m↑mi↓r̃i↓* 'water' aslo lose their internal ↓'s when modified, as in the examples

(v) a. ọ↑dụdụ a↓h̃ụ↑ 'that spider'

b. m↑mir̃i a↓ra↓ 'breast milk'

These examples are taken from Ward (1936) and Welmers (1968). In the Ọ↑h̃ụh̃ụ↓ dialect described by Green and Igwe, an internal ↓ is retained when it is preceded in its phrase by more than a single syllabic segment. For example, 'pepper soup' is *mi↓r̃i ọ↓kụ↑* with the internal ↓ of *mi↓r̃i↓* preserved in the surface form.

[21] This contrast was first noticed by Welmers (1976).

[22] Notice that there is no associative ↓ between the nouns *akụ↑* 'price' and *w̃a↓aỹị↑* 'woman' in this example. The noun *w̃a↓* 'child/offspring' and other nouns which are related to it (e.g. *w̃a↓aỹị↑* 'woman', *w̃a↓ta↑* 'child', *w̃o↓ke↓* 'male') never have an initial associative ↓. This fact might be accounted for either by means of a special rule deleting the associative ↓ from a noun of this class, or by allowing the rule of ↓-Metathesis to transpose the associative ↓ with the syllable *w̃a* or *w̃o* as well as with a syllable which consists of a syllabic segment only.

[23] Speakers who pronounce the word for 'water' as *m↑mi↓r̃i↓* also make this change, so that in these dialects, the phrase of (6.4-5a) is pronounced

(vi) ụ↑dọ m↓mir̃i↓

This phrase suggests that there is an error somewhere in the analysis, for the following reason: I have assumed here that the associative ↓ is moved to the right of the syllabic nasal in a form like this by a rule of Syllabic Nasal Raising, which applies late in the derivation after Streamlining. If this assumption is correct, then at the time the rule of Sandwiched ↓ Deletion applies, the word *m↑mi↓r̃i↓* has the structure $[_{NP}$*↓m↑mi↓r̃i↓*$]$. Thus the rule of Sandwiched ↓ Deletion for this dialect would have to be stated

(vii) $_{[+N]}[\downarrow([+\mathrm{syll}]\uparrow)\ \sigma\ \downarrow\ \sigma\ \downarrow$

s.d. 1 2 3 4 5 6 7

s.c. Delete 5.

By allowing a tone marker between the controlling tone marker and the target tone marker, this rule violates the condition that the sphere of operation of a tone rule is confined to the string which includes the target tone marker and the tone markers which most immediately precede and follow it. The error may come at any of several points in the analysis. For example, the condition on the sphere of operation of tone rules may be too strong, so that the rule of (vii) is a well-formed rule after all. Alternatively, my assumption that the movement of the associative ↓ to the right of a syllabic nasal is accomplished by a late rule may be in error, though the evidence on which this assumption is based seems very strong. If the associative ↓ of (vii) were moved to the right by the rule of ↓-Metathesis, that at the time Sandwiched ↓ Deletion applied, this word would have the tone shape *m↓mi↓r̃i↓*, and the rule of Sandwiched ↓ Deletion for this dialect could take the form given in (6.3-6).

[24] One might try to capture the disjunctive ordering between these two rules by collapsing them in the manner shown below:

(viii) $_{[+N]}[\downarrow[+\text{syll}](\sigma\ \sigma)\ \ldots\downarrow\ldots]$

s.d. 1 2 3 4 5 6

s.c. If 3 is present, delete 1. Otherwise, move 1 to the right of 2.

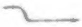
I do not know whether conditions of this sort should be allowed on phonological rules.

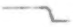
CHAPTER VII

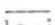
THE VERB FORMS OF IGBO

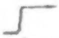
1. Introduction

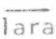
Igbo, like many African languages, uses tone contours as well as inflectional morphology to distinguish among the various grammatical forms of a verb. By way of illustration, some of the forms of the verb *la* 'leave'[1,2] are listed below, with their characteristic tone contours drawn above them:

(1-1) a.

alaɣị general negative

b.

alaɣị negative subordinate clause

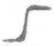
c.

laɣị negative consecutive

d.

alaa aff. main clause incompletive

e.

lara aff. main clause completive

f.

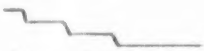
laa aff. conditional

g.

laa aff. imperative

It is the choice of prefix (if any) and the tone contour which distinguish one verb form from another -- suffixes like those which follow *la* in the examples above are aspectual elements which, though strongly preferred in most contexts, are not obligatory.

In addition to having their own characteristic tone contours, some verb forms also affect the tone contours of adjacent elements. For example, a "subordinate clause" verb like (1-1 b) causes the raising of a low-toned syllable which immediately precedes it, as in

(1-2)

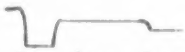


Ogu alaɣi̥ ahya 'Ogu, who left the market'

(*Ō gu*)

Other verb forms affect the tone contour of a FOLLOWING element. For example, the noun *ahya* 'market' acquires a downstep after its first syllable when it is preceded by an affirmative conditional verb, as in the example

(1-3)



Ogu laa ahya 'If Ogu leaves the market'

I will begin this study of the Igbo verb forms with a description of the morphological composition of the verb, in section 2 below. In section 3, I will propose rules to account for the characteristic internal tone contours of the various verb forms. In section 4, I will compare the analysis given in section 3 with that proposed by Goldsmith (1976). In section 5, I will argue for a rule which inserts a relational morpheme of the form [↓] between the subject and the predicate of an affirmative statement. Finally, in section 6, I will account for the special behavior of the cliticizing subject pronouns.

2. The Structure of the Verb

2.1 The root level. There are at least three levels of structure in an Igbo verb. At the deepest level lies the verb "root".[3]

A verb root may be simple or complex. "Simple" verb roots like *we↑* 'pick up' and *la* 'leave' are monosyllabic, with the syllabic structure C_1V. They are divided into two tonal classes: "low-toned" roots like *we↑* and "toneless" roots like *la*. Evidence for the tonelessness of simple verb roots like *la* will be given in sections 3.1 and 3.3 below.

A complex root may be made up of two or more simple roots. For example, the verb root *we↑la* 'take away' contains the two simple roots *we↑* and *la*. The root *ga↓femi↑*[4] 'go out of one's depth' is made up of the simple roots *ga* 'go' and *fe↑* 'pass', and *mi↑* 'be deep'.

A verb root may also contain one or more suffixes. A few of the more common root-level suffixes listed by Welmers (1970a) are as follows:

(2.1-1) a. *-we/-wa* indicating an action in progress. (e.g. *gawa* 'get going', from *ga* 'go' + *-wa*)

b. *-ta/-te* indicating action toward the subject or the speaker. (e.g. *zụta* 'buy', from *zụ* 'purchase' + *-ta*)

c. *-ca* indicating completion of an action (e.g. *rica* 'eat up', from *ri* 'eat' + *-ca*)

d. *-hye↑* indicating action done in a wrong way, or by mistake. (e.g. *ga↓hye↑* (+obj. 'road') 'go the wrong way', from *ga* 'go' + *hye↑*)

e. *-gide* indicating continuation of an action (e.g. *rụgide* 'keep on working', from *rụ* 'work' + *-gide*)

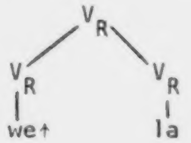
The statement of rules for the formation of complex verb roots from simple ones is not a straightforward task. If we assume the two lexical structure rules

(2.1-2) a. $V_R \rightarrow V_R + V_R$

b. $V_R \rightarrow V_R + \text{SUFF}$

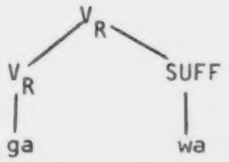
then the verb root *we↑la* 'take away' will have the structure

(2.1-3)



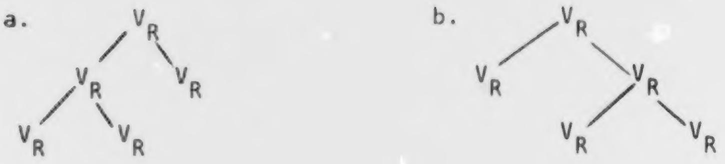
and the verb root *gawa* 'get going' will have the structure

(2.1-4)



But notice that rule (2.1-2 a) predicts that there should be three-part roots with both the following structures:

(2.1-5)



a. b.

There are many verb roots which have the structure of (a). For example, *ga↓femi↑* 'go out of one's depth' (*ga* 'go' + *fe↑* 'pass by' + *mi↑* 'be deep') almost certainly has this structure, since *ga↓fe↑* exists as an independent root, but there is no independent root **fe↓mi↑*. However, I know of no verb roots with the structure of (b). If roots of the form (2.1-5 b) do not exist, then that fact casts doubt on the existence of rule (2.1-2 b). We can eliminate this rule and derive all complex verb roots by means of rule (2.1-2 b) if we assume that those simple verb roots which appear in non-initial positions have, in fact, been made into suffixes. This hypothesis is supported by the fact that there are heavy restrictions on the occurrence of simple verb roots in non-initial positions. For example, Welmers (1970a) notes that only those simple roots which indicate motion (e.g. *ga* 'go') or states (e.g. *mi↑* 'be deep') may occur in third position in a verb root. The following list given by Igwe and Green (1970) of verb roots commonly appearing in non-initial position in a verb root suggests that the class of verb roots which may occupy ANY non-initial position is a very limited one:

(2.1-6)	bha↑	'enter' as in *du↓bha↑* 'lead in'
	fu↑	'be lost', as in *me↓fu↑* 'use up'
	ga	'separate'
	gbu	'kill', as in *megbu* 'oppress'
	gwa	'add', as in *wegwa* 'also have'
	hu	'bend', as in *gahu* 'go back'
	je	'go' as in *nuje* 'jostle along'
	ju	'be full', as in *y̆eju* 'give in full'
	ka	'surpass', as in *gụkarị* 'read too much'
	ke↑	'share out'
	kwhu	'join'
	kwhu↑	'meet'

(2.1-6)	li	'move', as in *bili* 'get up'
	ma	'be good', as in *leruma* 'look carefully'
	zi	'be right', as in *mezi* 'do well'

If it is in fact the case that only a very limited class of simple verb roots may occupy non-initial position within a complex verb root, then that fact suggests that these verb roots simply have corresponding suffixal forms, and that complex verb roots in Igbo are all built according to the lexical structure rule of (2.1-2 b).[5]

Something should be said here about the processes of vowel and nasal harmony, which affect many affixal elements within the verb. Of the root-level suffixes listed in (2.1-1), two of them -- *wa/we* and *ta/te* -- are members of the class of harmonizing affixes. The vowel of a harmonizing suffix agrees with that of the preceding suffix or verb radical in the feature [±Advanced Tongue Root] ([±ATR]), where the [-ATR] vowels are [a], [ọ], [ụ], and [ị], and the [+ATR] vowels are [e], [o], [u], and [i].

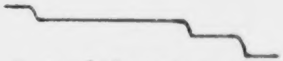
In many dialects of Igbo, including the Ọ↑hụ̃hụ̃↓ dialect described by Green and Igwe (1963), harmonizing suffixes also undergo nasal harmony. In these dialects, both the consonant and the vowel of a harmonizing suffix like *wa/we* become nasalized when the preceding verb radical or suffix is nasal, as in the verb root *z̃u↑w̃e*[6] 'begin to hide' (from *z̃u↑* + *we*). Noncontinuant consonants block the spread of nasality, so that the suffix *ta/te*, for example, undergoes vowel harmony only, and not nasal harmony.

2.2 The stem level. Welmers (1970a) lists a second set of verb suffixes which always appear outside the verb root. Some of the more common suffixes of this class are listed below:

(2.2-1)	a.	*-rV*	past time. Occurs only in the completive and negative verb forms. (The term "completive" will be defined below, in section 3.)
	b.	*-la/-le*	perfective. Can be found in any affirmative verb form, but is typical of the incompletive form.
	c.	*-be↑*	translated as "ever" or "yet". Occurs in questions and negatives only.

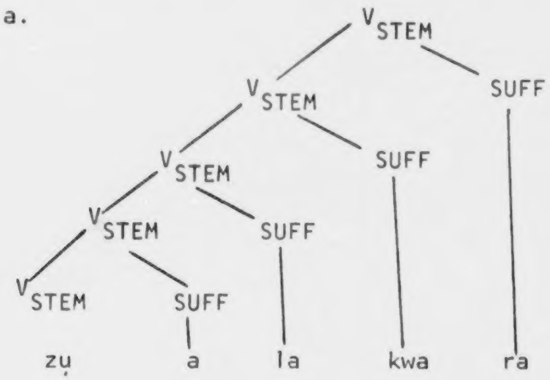
(2.2-1)	d.	*-γị/-γi-*	emphatic. Typically occurs in the negative verb forms.
	e.	*-a/-e/-ọ/-o*	Indicates completion of an action. Typically found in the affirmative imperative, consecutive, conditional, and incompletive forms. Without this suffix, a verb in one of these forms has a sense of "beginning to do something rather than of actually doing it." (Green and Igwe (1963), p. 59)
	f.	*-ra/-re*	applicative. Indicates that the action is applied to or performed for someone. Occurs in all verb forms.
	g.	*-kwa/-kwe*	"also" (sometimes used just for politeness). Occurs in all verb forms.

The stem-forming suffixes listed above differ from the root-level suffixes of (2.1-1) both in their position within the verb and in the fact that their presence or absence is closely related to the form of the verb. I therefore assume that these suffixes enter the verb at a higher structural level, that is, that they combine with a verb root to form a verb stem.[7] Thus the verb of the sentence below, which contains four suffixes of this class, will have one of the internal structures shown in (2.2-3):

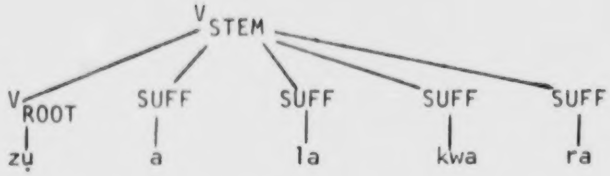
(2.2-2) 

Ọ zụalakwara m akwa. 'He has bought cloth for me.'

(2.2-3) a.



(2.2-3) b.



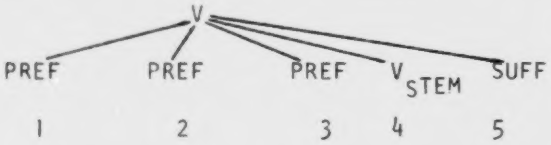
Since, to my knowledge, there is no evidence for an internal structure as complex as that of (2.2-3 a), I will assume that a verb stem has the flat multi-limbed structure of (b). The rule which introduces the stem-forming suffixes into the verb may thus be stated as follows:

(2.2-4) $V_{STEM} \rightarrow V_{ROOT}$ SUFF*

The reader will probably have noticed that the stem-forming suffixes of (2.2-1) are almost all of the harmonizing class. Several of these suffixes also harmonize in features other than nasality and position of tongue root; for example, the vowel of the past time suffix *-rV* (2.2-1 a) assimilates completely to the preceding vowel, and the "open vowel" suffix *-a/-e/-ọ/-o* (2.2-1 e) harmonizes with the preceding vowel in frontness or backness as well as in the feature [±ATR].

2.3 The word level. An Igbo verb is formed by combining a verb stem with up to three prefixes and a suffix, as shown below:

(2.3-1)



The choice of affix for each of the four affix positions is what determines the form of the verb. The innermost prefix position (position 3) is the most important. The choice of prefix for this position determines whether the verb is affirmative or negative, whether it is in the indicative, conditional, infinitive, or imperative form, and, if it is in the indicative form, whether it is "completive" or "incompletive" and "consecutive" or "non-consecutive". The prefixes which may be chosen for this position and their contribution to the form of the verb are shown below:

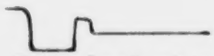
(2.3-2) a. *a↓-/e↓-* Marks the verb as being in a negative, non-consecutive verb form. This prefix is used for the negative infinitive, imperative, and conditional forms as well as for the negative indicative forms.

(2.3-2)	b.	↑-	Marks the verb stem as being in the negative consecutive form.
	c.	*ị↓-/i↓-*	Marks the verb stem as being in the affirmative infinitive form.
	d.	*a↑-/e↑-*	Marks the verb as being in the affirmative incompletive form, either consecutive of non-consecutive.
	e.	↑-	Marks the verb as being in the affirmative, completive, non-consecutive form.

In addition, there are several verb forms which take Ø-prefixes in position 3; they are the affirmative completive consecutive form, the affirmative conditional form, and the affirmative imperative form.

Of the prefixes listed in (2.3-2), those with phonetic content ((a), (c), and (d)) are the most easily motivated, for the negative non-consecutive forms obviously begin wtih a [a] or [e] with a pitch drop after it, the infinitive form with a [ị] or [i] with a pitch drop after it, and the affirmative incompletive with a [a] or [e] with a pitch rise after it. Examples of these three verb forms are given below:

(2.3-3) a.

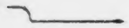


Ogu alaγị ahya 'Ogu didn't leave the market'

(from *O↓gu↑* + *a↓laγị↓* + *ahya↓*)

'didn't leave''market'
(negative non-
consecutive form)

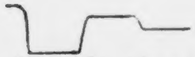
b.



ịla ahya 'to leave the market'

(*ị↓la↓* 'to leave' (affirmative infinitive form))

c.



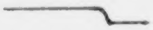
Ogu ala ahya! 'Ogu is leaving the market!'

(*a↑la↓* (affirmative incompletive form))

The purely tonal prefixes ((2.3-2 b) and (2.3-2 e)) will be motivated in section 3.1 below, in connection with the rule of Verb-final Tone Marker Insertion.

Something should be said here about the meanings of the verb forms which are distinguished from one another by the choice of prefix in position 3. Of the four verb "moods" (the infinitive, the imperative, the indicative, and the conditional), the first three need no particular comment. The fourth mood, the conditional, is used in conditional clauses such as

(2.3-4)



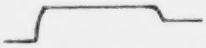
Ya la ahya 'if he leaves the market'

(from *ya*↓ + *la*↓ + *ahya*↓)

'he' 'leaves' 'market'
(cond. form)

in hortatives,

(2.3-5)



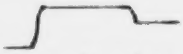
ka aỹị la ahya 'Let's leave the market'

(from *ka*↑ + *aỹị*↓ + *la*↓ + *ahya*↓)

'that' 'we' 'leave' 'market'
(cond. form)

in clauses of purpose

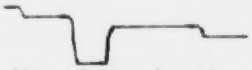
(2.3-6)



... ka ọ la ahya 'so that she could leave the market'

and, in general, to indicate that the proposition which the clause expresses is modally qualified:

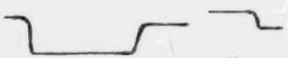
(2.3-7)



ikwe ka o la ahya 'to allow that she should leave the market'

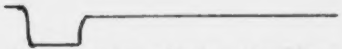
Verbs in the indicative form are divided into the two sub-forms "consecutive" and "non-consecutive". The consecutive form is used for the second of a pair of conjoined sentences, or as complement to certain verbs. Examples are given below, with the consecutive verb underlined in each example.

(2.3-8) a.



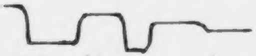
Ogu gara ahya, h̃ụ m. 'Ogu went to the market and saw me.'

b.



Ogu agala gbụta ahyịhya. 'Ogu had gone to collect leaves.'

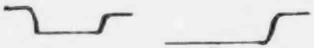
c.



O bu ibu aga ahya. 'He's carrying a load to market.'

(Literally, 'He's carrying a load and going to market.')

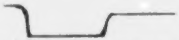
d.



Ị h̃ụr̃ụ ya, ya h̃ụỹị gị. 'You saw him, but he didn't see you.'

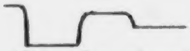
In addition, verbs in the affirmative indicative form are classified as either "completive" or "incompletive". The semantic difference between these two verb forms is subtle; however, very generally, the completive refers to complete events or states, while the incompletive refers to events which are incomplete. Examples of the completive and incompletive forms are given below:[8]

(2.3-9) a.



Aỹị la ahya! 'We must leave the market!' (completive)

b.



Aỹị ala ahya! 'We are leaving the market!' (incompletive)

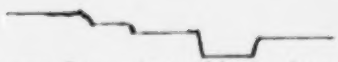
Depending on the context and choice of suffix, a verb in the incompletive form may be translated into English as a progressive, perfect, or future form. An active verb in the completive form is ordinarily translated as a past tense verb, while a stative verb in this form may be translated as either past or present. The distinction between the completive and incompletive is not made in the negative, and, in addition, there are no special negative infinitive and negative conditional forms. As a result, there are fewer distinct negative verb forms than affirmative verb forms.

A summary of the verb forms which are distinguished from one another by the choice of prefix in third position is given in the table below:

				PREFIX
AFFIRMATIVE	INFINITIVE			¡↓/i↓
	IMPERATIVE			Ø
	CONDITIONAL			Ø
	INDICATIVE	CONSECUTIVE[9]	COMPLETIVE	Ø
			INCOMPLETIVE	a↑/e↑
		NONCONSECUTIVE	COMPLETIVE	↑
			INCOMPLETIVE	a↑/e↑
NEGATIVE	INFINITIVE			a↓/e↓
	IMPERATIVE			a↓/e↓
	CONDITIONAL			a↓/e↓
	INDICATIVE	CONSECUTIVE		↑
		NONCONSECUTIVE		a↓/e↓

Now consider the middle prefix position (position 2 in (2.3-1)). The choice of prefix for this position indicates whether the verb is in a main or subordinate clause form. The choice here is between a prefixal ↓, which marks the verb as a "subordinate clause" form, and a Ø-prefix, which marks it as a "main clause" form. The "subordinate clause" ↓ can be seen at the beginning of the verb of the subordinate clause below:

(2.3-10)



anụ O↓gu ↓atụ↓bha↑ ọhya↓ 'the meat (which) Ogu should have thrown away into the bush'

(from *anụ↓* + *O↓gu↑* + *↓a↑tụ↓bha↑* + *ọhya↓*)
'meat' 'should have thrown away' 'bush'
(aff. incompletive sub. clause form)

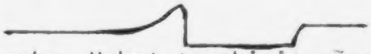
Notice that the rules of Right and Left Streamlining have applied in the environment of the subordinate clause ↓ in the example above to delete the ↑ at the end of *O↓gu↑* and the ↑ of the affirmative incompletive prefix *a↑*. The derivation of this clause is shown below:

(2.3-11)

anụ↓## O↓gu↑## ↓a↑tụ↓bha↑ ## ọhya↓	Underlying form
Ø	Right Streamlining
Ø	Left Streamlining
Ø	Like-TM Deletion
↓ ↓	↓-Reduction
anụ O↓gu ↓atụ↓bha↑ ọhya↓	Output

That the subordinate clause ↓ is part of the verb itself and not an independent constituent PRECEDING the verb is shown by the fact that the rule of Left Streamlining does not delete the tone marker at the end of the subject when the verb begins with a consonant, as in the example:

(2.3-12)



mgbe Ugho↑ ↓mechiri↑ ay̆a↓ 'when Ugho shut his eyes'

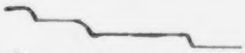
(from *mgbe↑* + *Ugho↑* + *↓mechiri↑* + *ay̆a↓*)

'time' 'shut' 'eyes'
(aff. completive sub. clause form)

This example shows that, with respect to the rule of Left Streamlining, the subordinate clause ↓ behaves like the associative ↓ of the common noun possessive rather than like that of the proper noun possessive (which ALWAYS causes the deletion of the tone marker at the end of the preceding word). I therefore assume that the associative ↓ occupies the same syntactic position as the associative ↓ of the common noun possessive; in other words, it must be a prefix of the verb and not a particle which lies between the subject and the verb. (See the discussion in Chapter II, section 3.4, of this difference between the associative ↓ of the proper name possessive and that of the common noun possessive.)

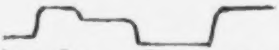
It is important to note that the distinction between "main" and "subordinate" clauses which is indicated in Igbo by the presence or absence of a ↓ in the second prefixal position, is not the same as the distinction between "root" and "non-root" clauses made by Emonds (1976).[10] A clause is classified as a "subordinate" clause if it is a relative or (nonconditional) adverbial clause, as in the examples below:

(2.3-13) a.



O↓gu ↓lara a↓hya↓ 'Ogu, who left the market'

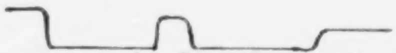
b.



ka↑ O↓gu ↓lara↑ ahya↓ 'when Ogu left the market'

However, the class of subordinate clauses is not co-extensive with the class of embedded clauses, because "noun" clauses of the type shown in the example below take the MAIN clause form (as can be seen from the fact that there is no drop in pitch at the beginning of the verb):

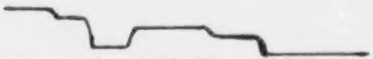
(2.3-14)



m mara ka Ogu lara ahya 'I know that Ogu left the market'

Furthermore, it is not the case that all "subordinate" clauses are modificational in function. For example, the underlined clauses in the examples below contain the verb-initial pitch drop which characterizes the subordinate clause forms:

(2.3-15) a.

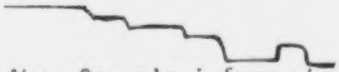


Eɣu m ka Ndi Ekpe jidhere. '(It was) my goat that the Ekpe people seized.'

(from *eɣu↓* + *m↓* + *ka↑* + *Ndi E↓kpe↓* + ↓ + *↑jidhere↑*)

'goat' 'my' 'that' 'Ekpe people' 'seized'

b.



Ahya Ogu alaɣị fụrụ ụka. 'The fact that Ekwe didn't leave the market caused trouble.'

(from *ahya↓* + *O↓gu↑* + *↓ala↓ɣị↓* + *fụrụ↑* + *ụ↓ka↑*)

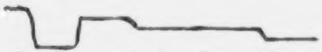
'market' 'didn't leave' 'caused' 'trouble'

If we assume that an adverbial clause like (2.3-13 b) has a "missing" time element, then what these subordinate clauses have in common is that some element is missing from each of them -- either by deletion (as in the examples of (2.3-13)) or by topicalization (as in the examples of (2.3-15)).[11] Consideration of related languages such as Twi, which make this same distinction between subordinate clause and main clause forms but use a pronoun for the relativized item of a relative clause, suggests that a subordinate clause should be defined as one which contains a bound variable.[12] However, how the presence of a bound variable in a clause could affect the choice of prefix in the verb is a question which needs further investigation.

Next, let us consider the leftmost prefix position, position I in the diagram of (2.3-1). This position may be occupied by either of two prefixes, one of which is relevant only to the subordinate clause forms, and the other of which is relevant only to the main clause forms.

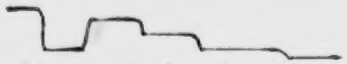
In the subordinate clause verb forms, this first prefix position may be occupied by a relative marker *na*, which optionally but preferably appears at the beginning of a relative clause verb (except in the affirmative completive form). Examples of relative clause verbs with this optional prefix are given below; notice that the prefix *na* precedes the subordinate clause ↓:

(2.3-16) a.



O↓gu↑ na↓alaala a↓hya↓ 'Ogu, who has left the market'

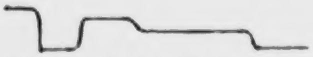
(2.3-16) b.



O↓gu↑ na↓ala↓γị a↓hya↓ 'Ogu, who didn't leave the market'

As was noted above, the prefix *na* does not occur in the completive form:

(2.3-17)



*O↓gu↑ na↓lara a↓hya↓ 'Ogu, who left the market'

I have no explanation to offer for this restriction on the distribution of this prefix.

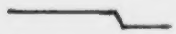
There is another verb prefix, the prefix ↑, which also goes in first position in the verb. This prefix appears in main clause forms only, where it marks the verb as a question or negative form with pronominal subject.[13] The "question" ↑ will be motivated in section 3.2 below, in connection with the discussion of the rule of Negative ↓ Shift.

The choice of prefix for the first and second prefix positions is summarized in the following chart:

Position	Distinction made		Prefix
2	Subordinate clause		↓
	Main clause		0
1	Subordinate clause	relative clause (except aff. completive)	na (opt.)
		other	0
	Main clause	negative or question with pronominal subject	↑
		other	0

Finally, let us consider the suffix position at the end of the verb. (See the diagram of (2.3-1).) In about half the verb forms of Igbo, this suffixal position is occupied by a ↓. Like the associative ↓ of the common noun possessive, the suffixal ↓ cliticizes to a following nominal constituent, and if the first syllable of that constituent is a high-toned syllabic segment, is transposed with it by the rule of ↓-Metathesis. Thus in the example below, the suffixal ↓ appears in the surface form after the first syllable of the object NP *ahya* 'market':[14]

(2.3-18)



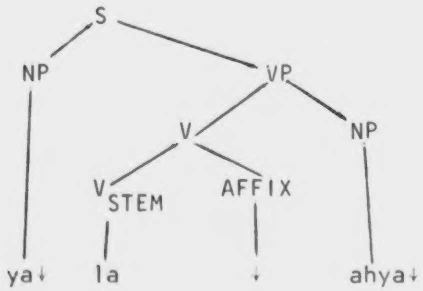
Ya la a↓hya↓ 'if he leaves the market'

(from *ya*↓ + *la* + ↓ + *ahya*↓)

'he' 'leave' (conditional form) 'market'

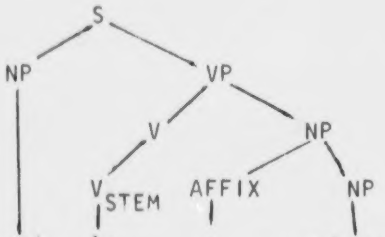
If we assume that this clause has the underlying structure shown below:

(2.3-19)



then its surface tone contour can be derived as follows:

(2.3-20)



ya↓	la	↓	ahya↓	By ↓-Cliticization
		∅		By ↓-Metathesis
ya↓##	la	##	a↓hya↓	Conversion to Word Boundaries
∅				Like-TM Deletion
			↓	↓-Reduction
ya	la	a↓hya↓		Output

The rules of ↓-Cliticization and ↓-Metathesis are repeated below for the convenience of the reader:

(2.3-21) a. ↓-Cliticization.

$$[[\ldots]\ \begin{bmatrix}\langle +N\rangle_a\\ \langle -AGENTIVE\rangle_b\end{bmatrix}^{[\downarrow]}\ \begin{bmatrix}+N\\ \langle +PROPER\rangle_c\\ \langle -POSSESSIVE\rangle_d\end{bmatrix}^{[\ldots]]}$$

s.d. 1 2 3

s.c. Adjoin 2 to 3.

Condition: (a ⊃ b) and (c ⊃ d)

b. ↓-Metathesis.

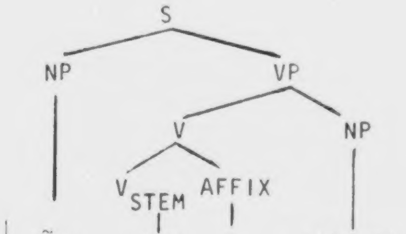
$$[+N]^{[\downarrow[+syll]\ \ldots\ \downarrow}$$

s.d. 1 2 3 4

s.c. Move 1 to the right of 2.

When the nominal phrase to which the suffixal ↓ attaches does not begin with a high-toned syllable segment, ↓-Metathesis cannot take place, and the ↓ remains at the beginning of the object NP, where it causes the deletion, by Left and Right Streamlining, of any tone marker within a certain distance on either side of it. An example is given below:

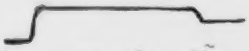
(2.3-22)



aỹị↓ ke↑ ↓ a↑khwa↓	'if we begin to share out the eggs' (underlying form)
aỹị↓## ke↑##↓# a↑khwa↓	By ↓-Cliticization and subsequent conversion to word boundaries
Ø Ø	By Streamlining
Ø	By Like-TM Deletion
↓	By ↓-Reduction
aỹị ke↓ akhwa↓	Output

Sometimes the constituent which follows the verb is not nominal, as in the examples below, where it is (a) a verb and (b) a prepositional phrase. In that case ↓-Cliticization cannot apply, and the suffixal ↓ remains in its underlying position at the end of the verb, where, with respect to subsequent rules, it behaves exactly like any other word-final ↓. In particular, if the next tone marker of the string is also a ↓, as it is in these examples, then the suffixal ↓ is deleted by the rule of Like-Tone-Marker Deletion, and there is no drop in pitch at the beginning of the constituent which follows the verb:

(2.3-23) a.

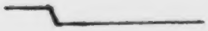


ka m ga rịtụ ih̃ye 'Let me go and eat something.'

(from *ka↑* + *m* + *ga* + ↓ + *rịtụ* + ↓ + *ih̃ye↓*)

'that' 'me''go' (conditional form) 'eat' (consec. form) 'something'

b.



ndị nọ na ahya 'the people (who) were in the market'

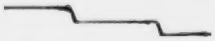
(from *ndị↓* + *↓nọ* + ↓ + *na ahya↓*)

'people' 'be' (completive subj. cl. form) 'in the market'

The examples above show that with respect to the rules of ↓-Cliticization and ↓-Metathesis, the suffixal ↓ which appears at the end of certain verb forms in Igbo behaves exactly like the associative ↓ of the common noun possessive. Evidence that this ↓ originates as a suffix of the verb rather than as an independent relational particle between the verb and its object will be given in section 3.1 below, in connection with the rule of Verb-final Tone Marker Insertion.

Now consider the distribution of the suffix "↓" among the verb forms of Igbo. Among the subordinate clause verb forms, this suffix appears in the verb just in case the subject of the clause is the relativized item, as in the example below. (Note that the subject of the clause, being the relativized item, has been deleted, and that the suffixal ↓ has cliticized to the object noun *ahya↓* 'market' and been transposed with the initial vowel of *ahya↓*):

(2.3-24)



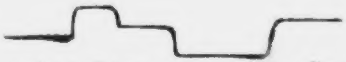
oỹe ↓la a↓hya↓ 'anyone (who) leaves the market'

(from *oỹe↓* + *↓la* + ↓ + *ahya↓*)

'anyone' 'leave' 'market'
(aff. completive
sub. cl. form)

In a subordinate clause which has an overt subject, there is no suffixal ↓ at the end of the verb, as can be seen from the example below:

(2.3-25)



mgbe↑ O↓gu ↓emechi↑ aỹa↓ 'when Ogu should have shut his eyes'

(from *mgbe↑* + *O↓gu↑* + *↓e↑mechi↑* + *aỹa↓*)

'time' 'shut' 'eyes'
(aff. incompletive
sub. cl. form)

Among the main clause verb forms, the distribution of the suffix ↓ has nothing to do with whether or not there is an overt subject; instead, the presence or absence of this suffix correlates with a certain semantic feature of the verb. In particular, this suffix appears in just those verb forms which typically make use of the open vowel suffix *-a/-e/-ọ/-o* and which, without this suffix, have a sense of beginning to do something rather than of actually doing it. The main clause verb forms which share this semantic property (which I will call "incipiency") are listed below:

(2.3-26) a. the affirmative imperative

b. the affirmative conditional

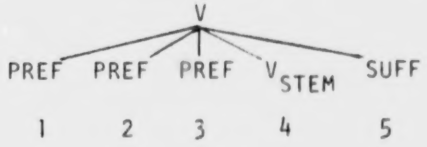
c. the affirmative consecutive, both completive and incompletive

d. the affirmative incompletive

These are exactly the main clause verb forms in which the suffixal ↓ appears.

In summary, I have argued in this section that a verb of Igbo has the structure

(2.3-27)



The prefix in third position indicates whether the verb is affirmative or negative, whether it is indicative, imperative, infinitival, or conditional, and, if it is indicative, whether it is consecutive or non-consecutive and completive or incompletive. The prefix in second position indicates whether the verb belongs to a main or subordinate clause. The choice of prefix in the first position depends on whether the verb is in a main or subordinate clause form. If it is a subordinate clause form, the prefix *na* is optionally but preferably chosen for relative clauses in the negative or affirmative incompletive form. For main clause verbs, the choice is between no prefix and a prefixal ↑, which marks the verb as the head of a question or negative with pronominal subject. Finally, there is a suffixal ↓, which appears in main clause verbs with the property I have called "incipiency" and in subordinate clause verbs which have no overt subject (i.e., in which the subject is the bound variable).

The way in which the choice of affixal elements determines the form of the verb can be stated in a very straightforward manner if we consider prefixes and suffixes to be bundles of syntactic features which may or may not have associated phonological material. In this view, the rule for the formation of a lexical verb from a verb stem may be stated as follows (the symbol "Ø" is used here to indicate that a particular prefix or suffix has no phonological realization):

(2.3-28) $\text{V} \rightarrow \text{PREF}_1\ \text{PREF}_2\ \text{PREF}_3\ \text{V}_{\text{STEM}}\ \text{SUFF}$

where

$$\text{PREF}_1 \rightarrow \underset{\begin{bmatrix} -\text{SUB CL} \\ [+\text{PRO}]\underline{\quad} \\ +\text{Q} \\ +\text{IND} \end{bmatrix}}{\uparrow}, \underset{[+\text{REL CL}]}{\text{na}}, \underset{[-\text{Q}]}{\emptyset}, \underset{[-\text{IND}]}{\emptyset}, \underset{[[-\text{PRO}]\underline{\quad}]}{\emptyset}, \underset{[+\text{SUB CL}]}{\emptyset}$$

$$\text{PREF}_2 \rightarrow \underset{[+\text{SUB CL}]}{\downarrow}, \underset{[-\text{SUB CL}]}{\emptyset}$$

(2.3-28)

$$\text{PREF}_3 \rightarrow \overset{a\downarrow}{\begin{bmatrix}-\text{AFF}\\-\text{CONSEC}\\-\text{INCIP}\end{bmatrix}}, \overset{\uparrow}{\begin{bmatrix}+\text{AFF}\\+\text{CONSEC}\\-\text{INCIP}\end{bmatrix}}, \overset{a\uparrow}{\begin{bmatrix}+\text{IND}\\-\text{COMPL}\\+\text{INCIP}\\+\text{AFF}\end{bmatrix}}, \overset{\emptyset}{\begin{bmatrix}+\text{AFF}\\+\text{INF}\\-\text{INCIP}\end{bmatrix}}, \overset{\uparrow}{\begin{bmatrix}+\text{AFF}\\+\text{IND}\\+\text{COMPL}\\-\text{CONSEC}\end{bmatrix}}, \overset{\emptyset}{\begin{bmatrix}+\text{AFF}\\-\text{INDIC}\\-\text{INF}\\+\text{INCIP}\end{bmatrix}}$$

$$\text{SUFF} \rightarrow \overset{\downarrow}{\begin{bmatrix}+\text{SUB CL}\\-\text{SUB}\end{bmatrix}}, \overset{\emptyset}{\begin{bmatrix}+\text{SUB CL}\\+\text{SUBJ}\end{bmatrix}}, \overset{\downarrow}{\begin{bmatrix}-\text{SUB CL}\\+\text{INCIP}\end{bmatrix}}, \overset{\emptyset}{\begin{bmatrix}-\text{SUB CL}\\-\text{INCIP}\end{bmatrix}}$$

The features which appear in the feature-matrices above are explicated below:

(2.3-29)	[±SUB CL]	: indicates whether the verb is to be the head of a main or subordinate clause.
	[±REL CL]	: indicates that the verb is (or is not) to be the head of a relative clause.
	[[±PRO]___]	: indicates that the verb must (or may not) have a pronoun as its subject.
	[±SUBJ]	: indicates that the verb must (or may not) have an overt subject.
	[±AFF]	: indicates whether the verb is affirmative or negative.
	[IND/COND/ IMP/INF]	: indicates whether the verb is in the indicative, conditional, imperative, or infinitive form.
	[±CONS]	: indicates that the verb is (or is not) a consecutive form.
	[±COMPL]	: indicates whether the verb is in the completive or the incompletive form.
	[±INCIP]	: indicates whether the verb does or does not have the property which I have called "incipiency"
	[±Q]	: a positive value for this feature indicates that the verb is the head of a question or negative, a negative value that it is not.

When a particular prefix or suffix is chosen the syntactic features associated with that prefix or suffix are copied onto the verb node itself. For example, if the prefix ↑[-SUB CL, [+PRO]___, +Q, +IND] is chosen for the first prefix position, then the verb as a whole acquires the features [-SUB CL], [[+PRO]___], [+Q], and [+IND]. Notice that the choice of this prefix for first position limits the choice of prefixes and suffixes for other positions; for example, the prefix Ø[+AFF, +COND, +INCIP] cannot be chosen for the third prefix position, for that prefix would give the verb the feature [+COND], but a verb cannot be both [+IND] and [+COND] at the same time.

Notice that every verb is marked for every feature. For example, the feature [±CONSEC] is relevant only to main clause indicative verbs; subordinate clause verbs and non-indicative verbs are not marked for this feature. Similarly, the features [±REL CL] and [±SUBJ] are relevant only to subordinate clause verbs, and the feature [±COMPL] is relevant only to affirmative indicative verbs. Furthermore, it is possible for a verb to be unmarked even for features which are relevant; for example, a verb with the prefix *a↓/e↓* in third prefix position is negative and non-consecutive, but it is unmarked as to whether it is indicative, infinitival, conditional, or imperative.

3. The rules which determine the internal tone contour of a verb.

3.1 Verb-final Tone Marker Insertion. Every verb ends with a tone marker. In those verb forms which choose the suffixal ↓, that ↓ is the final tone marker of the verb. In all other verb forms, the verb-final tone marker is inserted by a rule of the form

(3.1-1) Verb-final Tone Marker Insertion.

[+tone] ... $]_V$

s.d. 1 2

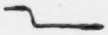
s.c. Copy 1 after 2.

Condition: 2 ≠ Ø

This rule copies the last internal tone marker of the verb at the end of the verb.

The effect of the rule may be seen, for example, in the infinitive forms

(3.1-2) a.

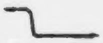


i↓meci↓ 'to shut'

(from *i↓* + *me* + *ci*)

inf. 'make' 'be shut'
pref.

b.



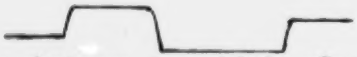
i↓wela↑ 'to take home'

(from *i↓* + *we↑* + *la*)

(inf. 'pick 'go home'
pref.) up'

In (b), where the verb contains a low-toned verb radical (*we↑*), the final tone marker of the verb is a ↑, making the verb stem low toned throughout. (The ↑ of *we↑* is subsequently deleted by the rule of Like-Tone-Marker Deletion before the ↑ at the end of the verb.) However, in (a), where there is no low-toned element within the verb, the last tone marker of the verb is the ↓ of the prefix; consequently, the verb-final tone marker is also a ↓, making the verb stem high toned throughout. The affirmative infinitive form, in which the prefix tone marker is a ↓, contrasts in this respect with the affirmative incompletive subordinate clause form, which uses the prefix *a↑*. In the latter verb form, the verb-final tone marker is invariably a ↑, even if there is no low-toned verb radical or suffix within the verb stem:

(3.1-3)



mgbe↑ eɣu ↓emechiri↑ aỹa↓ 'when the goat shut his eyes'

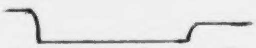
(from *mgbe↑* + *eɣu↓* + ↓ + *e↑* + *me* + *chi* + *rV* + *aỹa↓*)

'time' 'goat' (sub. (aff. 'make' 'be (past 'eyes'
cl. incomp. shut' time
pref) pref.) suff.)

Notice that the presence of "high-toned" verb radicals like *me*, *chi*, and *rV* never has any effect on the direction of the verb-final tone marker. The fact that verb radicals and suffixes of this class have no effect on the direction of the verb-final tone marker (and therefore no effect on the tone level of the verb stem) supports our hypothesis that verb radicals and suffixes of this class are toneless. Additional evidence in favor of this hypothesis will be given in section 3.3 below, in connection with the rule of Before-low ↓ Insertion.

The rule of Verb-final Tone Marker Insertion also provides evidence for the ↑ prefixes which we have hypothesized for the affirmative completive and negative consecutive verb forms (see section 2.3 above). The presence of a prefixal ↑ in these verb forms is indicated by the fact that in these verb forms, as in the affirmative incompletive subordinate clause forms of (3.1-3), the verb-final tone marker is a ↑ even when there is no low-toned verb radical or suffix within the verb:

(3.1-4) a.

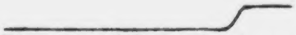


O↓gu mechiri↑ aỹa↓ 'Ogu shut his eyes'

(from *O↓gu↑* + ↑ + *me* + *chi* + *rV* + *aỹa↓*)

(aff. completive pref.) 'make' 'be shut' (past time suff.) 'eyes'

b.



Ekwe mechiɣi ŋke↑ ya↓ 'but Ekwe didn't shut his'

(from *Ekwe↓* + ↑ + *me* + *chi* + *ŋke↑* + *ya↓*)

(neg. consec. pref.) 'make' 'be shut' 'things' 'his'

Without the postulation of a prefixal ↑ in these verb forms, it would be difficult to explain why the rule of Verb-final Tone Marker Insertion inserts a ↑ at the ends of verbs like these, which contain no low-toned verb radicals or suffixes.

There is additional, independent evidence for a prefixal ↑ at the beginning of a negative consecutive verb, for a string of high-toned syllables is lowered before a verb in this form; for example, the high-toned subject *Ekwe↓* is lowered before the negative consecutive verb *↑mechiɣi↑* in (3.1-4 b) above. Assuming a prefixal ↑ at the beginning of a verb in this form, we may account for the lowering of the string of high-toned syllables at the end of the subject by means of the following generalized version of the rule of Left Streamlining:

(3.1-5) Left Streamlining[15]

σ [+tone] (#) (#) [+tone]

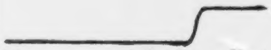
s.d. 1 2 3 4 5

s.c. Delete 2.

Condition: If 3 and 4 are both present, then 1 is not long.

Stated in this way, the rule of Left Streamlining will delete the ↓ at the end of a word when the following word begins with a ↑. The application of the rule is illustrated by the following derivation of the phrases of (3.1-4 b):

(3.1-6)

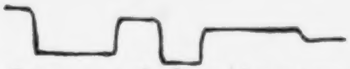
Ekwe↓ ##↑ + mechiɣi↑ ## aỹa↓	Underlying form after conversion to word boundaries
∅	Left Streamlining
∅	Like-TM Deletion
 Ekwe mechiɣi↑ aỹa↓	Output

In conclusion, there are two arguments for the existence of a prefixal ↑ at the beginning of a negative consecutive verb -- (i) the fact that the rule of Verb-final Tone Marker Insertion inserts a ↑ at the end of the verb even when there is no low-toned verb radical or suffix inside the verb, and (ii) the fact that a string of high-toned syllables at the end of the subject is lowered before the verb. Both these facts are accounted for by the postulation of a prefixal ↑ at the beginning of a negative consecutive verb.[16]

Unfortunately, it is not possible to give independent evidence for the prefixal ↑ which has been postulated here for the affirmative completive form; for reasons to be given below in section 5, the prefixal ↑ of this verb form does not affect the tone of the subject in the same way as does the prefixal ↑ of the negative consecutive verb form. Thus the argument for the existence of a prefixal ↑ in this verb form rests on evidence from the rule of Verb-final Tone Marker Insertion alone.

Up to now in this section we have been discussing just those verb forms in which the final tone marker of the verb is inserted by the rule of Verb-final Tone Marker Insertion. The reader will recall, however, that in main clause verb forms with the property of incipiency, and in subordinate clause forms in which the subject of the verb is a bound variable, there is a suffixal ↓ which acts as the final tone marker of the verb. In verb forms of this class, the rule of Verb-final Tone Marker Insertion does not apply, as can be seen from the following affirmative incompletive and affirmative conditional forms, which make use of the suffixal ↓. (Note that in the surface form the suffixal ↓ appears after the initial vowel of the object noun):

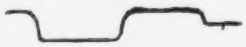
(3.1-7) a.



O↓gu a↑cị↓fụ↑sịla o↓ce↓ 'Ogu has carried out the chairs one by one.'

(from *O↓gu↑* + *a↓* + *cị* + *fụ↑* + *sị* + *la* +
(aff. incom. pref.) 'carry' 'go out' (dist. suff.) (perf. suff.)
↓ + *oce↓*)
(suff.) 'chairs'

b.



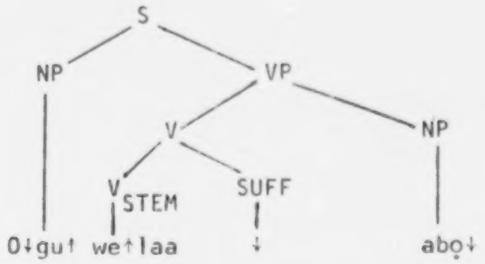
O↓gu we↑laa a↓bọ↓ 'If Ogu takes back the baskets'

(from *O↓gu↑* + *we↑* + *la* + *a* + ↓ *abọ↓*)
'pick up' 'go home' ("open vowel suffix") (suff.) 'baskets'

Observe that the rule of Verb-final Tone Marker Insertion has not applied to either of these forms, for if it had, it would have inserted a ↑ at the end of the verb.[17]

If the rule of Verb-final Tone Marker Insertion is a lexical rule, as one assumes it is, then the failure of the rule of Verb-final Tone Marker Insertion to apply to those verbs which use the suffixal ↓ is predicted by our analysis, for at the lexical level, the suffixal ↓ lies at the end of the verb and prevents the verb from meeting the structural description of the rule. There is a potential problem with this analysis which should be noted, however: it requires that the rule of ↓-Cliticization must be allowed to take a suffixal element from one word and attach it to the following word. For example, if we assume the following underlying structure for example (3.1-7 b):

(3.1-8)



then the rule of ↓-Cliticization must be allowed to remove the suffixal ↓ from the verb and attach it to *abọ↓*, for in the surface form, the suffixal ↓ appears after the first syllable of that noun.

The notion that a suffixal element can be removed from its underlying position inside one lexical item and adjoined to another lexical item is not an unusual one; for example, this assumption crucially underlies the "affix-hopping" rule on which Chomsky's (1957) analysis of the English auxiliary is built. Nevertheless, this notion has recently been challenged by Lapointe (1977), who proposes the following constraint on transformational rules:

(3.1-9) No transformation may modify lexical structure.

If Lapointe's constraint is correct, then the "suffixal" ↓ which appears at the end of certain verb forms in Igbo cannot be a suffix at all, but must be an independent syntactic entity (like the associative ↓), which is inserted by rule between a verb in one of certain verb forms and a following nominal phrase.

In an analysis along these lines, the "suffixal" ↓ is not present in the verb at the lexical level, and so it cannot block the application of Verb-final Tone Marker Insertion to the verb forms with which it appears. Instead, a historical explanation would have to be given for the fact that this rule does not apply to these verb forms. Such an explanation would go something like this: The "suffixal" ↓ which is associated with certain verb forms in Igbo was once an actual suffix of the verb, where, by its mere presence, it blocked the application of the rule of Verb-final Tone Marker Insertion. This suffix remained at the end of the verb in the surface form, for since it was part of the verb itself, it could not undergo cliticization to a following nominal phrase. However, as time went on, the suffixal ↓ was reanalyzed as an independent grammatical entity FOLLOWING the verb. Now it was free to undergo

↓-Cliticization, which would incorporate it into the nominal constituent following the verb, but it could no longer block the application of Verb-final Tone Marker Insertion. At this point, those verb forms which had historically failed to undergo Verb-final Tone Marker Insertion (because of the presence of the suffixal ↓) were simply marked as exceptions to this rule, which now came to be stated as follows:

(3.1-10) Verb-Final Tone Marker Insertion (alternative version)[18]

$$[\text{+tone}]\ \ldots\ ]_{\overset{V}{\begin{bmatrix}\langle\text{+INCIP}\rangle_a \\ \langle\text{+SUB CL}\rangle_b\end{bmatrix}}}$$

s.d. 1 2

s.c. Copy 1 after 2.

Conditions: (i) $2 \neq \emptyset$
(ii) $a \supset b$

Which view we adopt of the complementary distribution between the "suffixal" ↓ and the rule of Verb-final Tone Marker Insertion depends on whether or not we wish to include Lapointe's constraint (3.1-9) in our theory of grammar.

3.2 The rule of Negative ↓ Shift. When a negative verb, such as *a↓laγɨ↓* 'didn't leave' is put into the subordinate clause form, it acquires an initial prefixal ↓, as is usual for subordinate clause verbs. Now observe that if the ↓ of the negative prefix *a↓/e↓* were left in its underlying position in such a verb, it would be deleted by the rule of Right Streamlining in the environment of the subordinate clause ↓, and the distinction between the negative form (with prefix *a↓/e↓*) and the affirmative incompletive form (with prefix *a↑/e↑*) would be lost. This linguistic disaster is prevented by a rule which moves the ↓ of the negative prefix one syllable to the right when the prefix is preceded by a tone marker. The rule for this tone change may be stated as follows:

(3.2-1) Negative ↓ Shift.

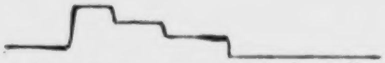
$${}_V[\ldots[\text{+tone}][\text{+syll}]\ \downarrow\ \sigma$$

s.d. 1 2 3 4 5

s.c. Move 4 to the right of 5.

The effect of this rule can be seen in the verbs of the negative subordinate clauses below. (The ↓ which has been shifted to the right is underlined in each case):

(3.2-2) a.

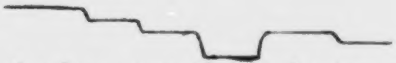


mgbe↑ O↓gu ↓eme↓chiγi aỹa↓ 'when Ogu didn't shut his eyes'

(from *mgbe↑* + *O↓gu↑* + ↓ + *e↓* + *me* + *chi* + *γi* + *aỹa↓*)

'time' (sub. cl. pref.) (neg. pref.) 'make' 'be shut' (neg. suff.) 'eyes'

b.



abọ O↓gu ↓ewe↓laγị↑ Enu↓gwu↓ 'the baskets (which) Ogu didn't take back to Enugu'

(from *abọ↓* + *O↓gu↑* + ↓ + *e↓* + *we↑* +

'baskets' (sub. cl. pref.) (neg. pref.) 'pick up'

la + *γị* + *Enu↓gwu↓*)

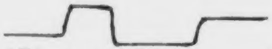
'go home' (neg. suff.) (place name)

Notice that as a result of the shifting of the ↓ of the negative prefix in these forms, the "high-toned" verb radical *me* of (a) and the "low-toned" verb radical *we↑* of (b) both have high tone in the surface form (that is, each of these verb radicals has a ↓ as the tone marker which most immediately follows it in the string). However, the information that the verb of (b) contains a low-toned verb radical while that of (a) does not is preserved in the surface form by means of the verb-final tone marker, which is a ↑ in *↓ewe↓la↑* (b), but a ↓ in *↓eme↓chi↓* (a).

If we assume that the movement of a tone marker to a word-internal syllable boundary causes the automatic deletion of any tone marker which formerly occupied that syllable boundary, then the shifting of the negative ↓ to the right in *↓ewe↓la↑* (from *↓e↓we↑la*) causes the automatic deletion of the lexical ↑ of *we↑*. The fact that the rule of Verb-final Tone Marker Insertion nevertheless inserts a ↑ at the end of *↓ewe↓la↑* is compatible with either of two hypotheses about the ordering of phonological rules within the lexical component. One possibility is that the rule of Verb-final Tone Marker Insertion is ordered before Negative ↓ Shift, so that it copies the ↑ of *we↑* at the end of the verb before that ↑ is replaced by the negative ↓. The other possibility is that these two rules are unordered with respect to one another, so that when a single string meets the structural description of both rules, the two rules apply simultaneously. Since I know of no instance in which a phonological rule of the lexical component applies to the OUTPUT of another rule, I will assume here that phonological rules within the lexical component are unordered.

Besides the subordinate clause prefix ↓, there is one other tonal prefix which may precede the negative *a↓-/e↓*, and that is the prefixal ↑ which occupies first position in the verb of a question or negative with pronominal subject. This prefixal ↑ can be seen, for example, in the following affirmative completive question, where it causes the deletion, by Left Streamlining, of the ↓ at the end of the subject pronoun *aỹị↓*:

(3.2-3)



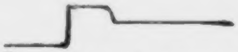
Aỹị ↑̲tụ↓bhara↑ ọnụ↓? 'Did we speak?'

(from *aỹị↓* + *↑̲tụ↓bha↑ra↑* + *ọnụ↓*)

'we' 'threw in' (aff. completive question form) 'mouth'

The same "question" ↑ which can be seen in the example above is also found in the negative question below, where it again causes the deletion of the ↓ at the end of the subject:

(3.2-4)



[19]

H̃a a↑la↓γị ahya↓? 'Didn't they leave the market?'

(from *h̃a↓* + ↑ + *a↓* + *la* + *γị* + *ahya↓*)

'they' (question prefix) (neg. pref.) 'leave' (neg. suffix) 'market'

Here the question ↑ has been moved to the right of the prefix vowel by a rule of ↑-Metathesis, which may be stated as follows:

(3.2-5) ↑-Metathesis

↑[+syll]

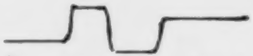
s.d.1 2 3

s.c.Move 2 to the right of 3.

This rule moves a word-initial ↑ (which can only be the "question" ↑) to the right of a following vowel, substituting it for the tone marker which follows that vowel in the underlying form. The application of this rule in (3.2-5) has given the question ↑ a surface position different from its underlying position. Nevertheless, there are two pieces of evidence which show that the question ↑ lies at the beginning of the verb in the underlying form: (i) the fact that it has caused the deletion of the final ↓ of the subject, thereby giving the subject low tone in place of its lexical high tone, and (ii) the fact that it has created an environment for Negative ↓ Shift, so that the ↓ of the negative prefix *a*↓ has been shifted to the right of the first verb radical *la*.

Notice that in the negative question form, as in the negative subordinate clause form, the underlying tone of the first verb radical is reflected in the direction of the verb-final tone marker rather than in the surface tone of that verb radical itself. Thus, in example (3.2-4), the first verb radical is a member of the toneless class, and the verb-final tone marker is a ↓(copied from the negative prefix *a*↓). However, in the example below, where the last internal tone marker of the verb is the ↑ of the low-toned verb radical *za*↑, the verb-final tone marker is a ↑, though *za*↑ itself has become high-toned in the surface form:

(3.2-7)



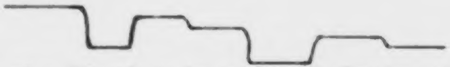
H̃a a↑za↓ɣị↑ ama↓? 'Didn't they sweep the path?'

(from *h̃a*↓ + ↑ + *a*↓ + *za*↑ + *ɣị* + *ama*↓)

'they' ("question" prefix) (neg. pref.) 'sweep' (neg. suff.) 'path'

There is one other fact about the rule of Negative ↓ Shift which we should take note of, and that is that the rule applies even when the relative prefix *na* is present at the beginning of the verb, as in the example below:

(3.2-8)



abọ O↓gu↑ ne↓ewe↓laɣị↑ Enu↓gwu↓ 'the baskets (which) Ogu didn't take back to Enugu'

(from *ne* + ↓ + *e*↓ + *we*↑ + *la* + ɣị)

(rel. marker) (sub. cl. prefix) (neg. pref.) 'pick up' 'take away' (neg. suff.)

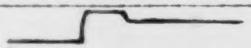
The possibility of a relative clause prefix at the beginning of the verb has been allowed for in the statement of Negative ↓ Shift (3.2-1) by including a variable at the beginning of the verb (term 1 in the rule). The derivation of this form is shown below:

(3.2-8) a. Derivation of the verb

↑ + a↓ + za↑ + γị ⟹ ↑aza↓γị↑

(by Neg. ↓ Shift and Verb-final Tone Marker Insertion)

b. Derivation of the clause:

h̃a↓ ## ↑aza↓γị ## ama↓	Underlying form after conversion to word boundaries
Ø	Left Streamlining
Ø → ↑	↑-Metathesis
 h̃a a↑za↓γị ama↓	Output

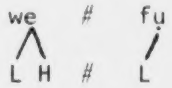
3.3 The rule of Before-low ↓ Insertion. Verb stems like *ga↓fe↑* 'go past' (*ga* 'go' + *fe↑* 'pass by'), *we↓fụ↑* 'take out' (*we↑* 'pick up' + *fụ↑* 'go out') and *bya↓be↑γi* 'haven't come' (*bya* 'come' + *be↑* (neg. perfective) + γ*i* (negative suffix)), which have a low-toned verb radical or suffix in non-initial position, have a drop in pitch after the first syllable. This generalization is true whether the verb radical in initial position in the stem is underlyingly toneless (like the *ga* of *ga↓fe↑*) or underlyingly low-toned, like the *we↑* of *we↓fụ↑*.

Goldsmith (1976) attributes the raising of a low-toned verb radical like *we↑* before a low-toned verb radical or suffix like *fụ↑* to the presence of a floating high tone in the lexical representation of each low-toned suffix. For example, in Goldsmith's analysis, the low-toned suffixal element *fụ↑* would be assigned the lexical representation

(3.3-1)
$$\begin{bmatrix} & \# & \text{fụ} \\ \text{H} & \# & \text{L} \end{bmatrix}$$

When *fụ↑* combines with a low-toned verb radical like *we↑* its floating high tone is mapped onto that verb radical, giving the intermediate representation shown below:

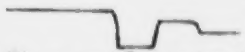
(3.3-2)



An independently-motivated rule of LH-Simplification converts the LH contour on *we↑* to a downstepped high tone ('H).[20]

There are several problems with an analysis along these lines. The first is that it gives the wrong tone contour for a verb stem like *we↓fụ↑*, for, as can be seen from the affirmative conditional form below, this verb stem has a HL rather than a 'HL contour:

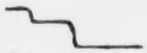
(3.3-3)



Ekwe we↓fụ↑ e↓go↓ 'if Ekwe takes away the money'

Secondly, Goldsmith's analysis fails to predict the correct tone contours for verbs like the following, in which there is an intermediate toneless suffix between the first verb radical and the low-toned suffixal element:

(3.3-4)



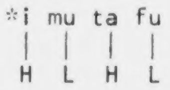
ị↓mụ↓tafụ↑ 'to learn more' (aff. infinitive)

(from *ị↓* + *mụ↑* + *ta* + *fụ↑*)

(aff. inf. pref.) 'learn' (suff.) 'be more'

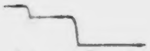
If there were really a floating high tone associated with the suffix *fụ*, then one would expect to find it mapped onto the toneless suffix *ta* in this form, giving the surface contour

(3.3-5)



Finally, Goldsmith's analysis predicts the wrong tone contour for verbs like the following, which contain a sequence of two low-toned elements:

(3.3-6)



ị↓ga↓femi↑ 'to go out of one's depth'

(from *i*↓ + *ga* + *fe*↑ + *mi*↑)

(aff. inf. pref.) 'go' 'cross' 'be deep'

Here Goldsmith's analysis predicts the raising of the low-toned verb radical *fe*↑, since it is followed by a low-toned suffixal element *mi*↑, but in fact, *fe*↑ keeps its lexical low tone in this form.

The correct generalization appears to be that whenever there is a low-toned element in non-initial position in the stem, there is a drop in pitch after the first syllable of the stem. Thus the correct tone contours for all the verb stems above can be obtained by means of the following rule:

(3.3-7) Before-low ↓ Insertion.[21]

$_{V_{STEM}}[\sigma\ \ (\uparrow)\ \ \ldots\ \ \uparrow$

s.d. 1 2 3 4

s.c. Substitute a ↓ for 2.

Condition: 3 ≠ Ø.

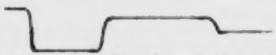
This rule inserts a ↓ after the first syllable of a verb stem which contains a subsequent low-toned element. For example, given the input [*mụ*↑ + *ta* + *fụ*↑] (3.3-4), it substitutes a ↓ for the ↑ of *mụ*↑. Similarly, given the input [*ga* + *fe*↑ + *mi*↑] (3.3-5), it inserts a ↓ after the first syllable *ga*.

Notice that verbal morphemes of the tonal class of *ga* and *ta* are entirely inert with respect to this rule, just as they were with respect to the rule of Verb-final Tone Marker Insertion. Thus the rule of Before-low ↓ Insertion provides additional justification for our assumption that verb radicals and suffixes of this class are toneless; only the inflectional affixes, and verb radicals and suffixes of the low-toned class, affect the tone contour of the verb in which they appear.

I argued above that there is a rule of Before-low ↓ Insertion in Igbo, which inserts a ↓ after the first syllable of a verb stem which contains a low-toned verb radical or suffix in non-initial position. Now observe that this rule also applies at the verb level. For example, the affirmative incompletive prefix *a*↑/*e*↑

normally contains a ↑, as in the example

(3.3-8)



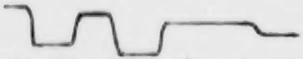
O↓gu a↑laala a↓hya↓ 'Ogu has left the market.'

(from *O↓gu↑* + *a↑laala* + ↓ + *ahya↓*)

'has left'
(aff. incompletive
form)

However, if the first verb radical of the verb is a low-toned verb radical like *za↑* 'sweep', then the rule of Before-low ↓ Insertion applies, replacing the ↑ of the prefix *a↑* with a ↓, as in the example

(3.3-9)



[22]

O↓gu↑ a↓za↑ala a↓ma↓ 'Ogu has swept the path.'

(from	*a↑* +	*za↑* +	*a* +	*la* +	↓)
	(aff. incompletive pref.)	'sweep'	("open vowel" suffix)	(perf. suff.)	(suff.)

Since the rule of Before-low ↓ Insertion applies at both the verb-stem level and the verb level, and since there is no reason why it should not be allowed to apply even at the verb-root level, it should be stated in such a way as to apply to any lexical verbal category. If we assume that the sublexical categories V_{STEM} and V_{ROOT} have the same major-class features as the lexical category V (i.e. [+V, -N]) and if we assume, furthermore, that the lexical and sublexical categories are distinguished from phrasal categories such as VP by some feature such as [+LEX], then the rule of Before-low ↓ Insertion may be stated as follows:

(3.3-10) Before-low ↓ Insertion (generalized version)

$$\left[\begin{array}{l}+V\\-N\\+LEX\end{array}\right.\!\left[\sigma\ \ (\uparrow)\ \ \ldots\ \ \uparrow\right.$$

s.d. 1 2 3 4

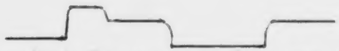
s.c. Substitute a ↓ for 2.

Condition: 3 ≠ 0.

Stated in this way, the rule of Before-low ↓ Insertion will apply to all the lexical verbal categories V, V_{STEM}, and V_{ROOT}.

Before leaving our discussion of the rule of Before-low ↓ Insertion, we should take note of some instances in which the rule does NOT apply. In particular, notice that if the rule is correctly stated in (3.3-10) above, then a prefixal tone marker at the beginning of the verb should block the application of the rule at the verb level (that is, it should prevent the rule from substituting a ↓ for the ↑ of the affirmative incomplete prefix a↑). That prediction of the analysis is borne out in fact, for there is no before-low ↓ after the prefix vowel in either of the examples below:

(3.3-11) a.



mgbe↑ O↓gu ↓azaala↑ ama↓ 'when Ogu had swept the path'

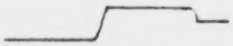
(from *mgbe↑* + *O↓gu↑* + ↓ + *a↑* +

'time' (sub. cl. pref.) (aff. incompletive prefix)

za↑ + *a* + *la* + *ama↓*)

'sweep' ("open vowel" suff.) (perfective suff.) 'path'

b.



H̃a aza↑ala a↓ma↓? 'Have they swept the path?'

(from *h̃a↓* + ↑ + *a↑* +

'they' ("question" prefix) (aff. incompletive prefix)

za↑ + *a* + *la* + ↓ +

'sweep' ("open vowel" suffix) (perfective suffix) (suff)

ama↓)

'path'

The application of Before-low ↓ Insertion to the verb of (a) is blocked by the presence of the subordinate clause ↓ at the beginning of the verb. Similarly, in (b), the application of the rule is blocked by the presence of the "question" ↑. Note that if a before-low ↓ HAD been inserted after the prefix vowel in either of these verbs, it would subsequently have been shifted to the right by the rule of Negative ↓ Shift (3.2-1), and would have appeared in the surface form after the verb radical *za*.

The fact that it blocks the application of Before-low ↓ Insertion in (3.3-1 b) provides additional evidence for the existence of the "question" ↑. Without the postulation of this prefixal element, it would be difficult to account for the change in the tone contour of the verb between the question form of (3.3-11 b) and the statement form of (3.3-9).

3.4 Imperative ↑ Insertion. So far, all the lexical rules which we have motivated for Igbo have applied to all lexical verbs without regard to form. However, there are two rules which apply to particular verb forms. The first of these is the rule which I will call Imperative ↑ Insertion. This rule inserts a ↑ after the first syllable of an imperative verb. The effect of the rule may be observed in the imperative forms below:

(3.4-1)	Ri/e!	'Eat!'	(*ri* 'eat' + -*e*)
	Gbụ/ọ!	'Kill!'	(*gbụ* 'kill' + -*ọ*)
	Zụ/ọ!	'Buy!'	(*zụ* 'buy' + -*ọ*)
	Yo/o!	'Swallow!'	(*yo* 'swallow' + -*o*)
	Li/te!	'Stand up!'	(*li* 'rise' + -*te*)

The rule of Imperative ↑ Insertion may be stated formally as follows:

(3.4-2) Imperative ↑ Insertion.

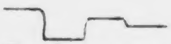
$${}_{\underset{[\mathrm{IMP}]}{V}}[\ \sigma\ \ (\ \sigma\ \dots\ )\ \ ]$$

s.d. 1 2 3

s.c. Insert a ↑ after 1.

The presence of term 2 in the structural description of the rule is necessary to account for the fact that no ↑ is inserted after the first syllable of a verb like *tụ↓fụ↑* 'throw away', as in

(3.4-3)



Tụ↓fụ↑e ↓ya↓ 'Throw it away.'

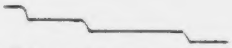
(from *tụ* + *fụ↑* + *-e* + *ya↓*)

'throw' 'go out' (suff.) 'it'

Since the rule of Before-low ↓ Insertion will already have applied to this verb at the stem level, its first syllable will already be followed by a ↓ (and not another syllable) when the verb level is reached. Thus the structural description of the rule of Imperative ↑ Insertion is not met, and no imperative ↑ is inserted.

3.5 ↑-Deletion. The verbs of the relative clauses in which the relativized item is the subject of the clause undergo a special rule which deletes any ↑ which would otherwise occur inside the verb. The effects of this rule can be seen in the following examples of this verb form:

(3.5-1) a.

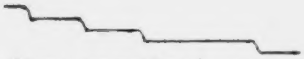


O↓gu ↓zara a↓ma↓ 'Ogu, who swept the path'

(from *O↓gu↑* + ↓ + *za↑* + *ra* + ↓ + *ama↓*)

(sub. cl. prefix) 'sweep' (past time suffix) (suff.) 'path'

b.



O↓gu ↓aza↓beɣi a↓ma↓ 'Ogu, who hasn't swept the path'

(from ↓ + *a↓* + *za↑* + *be↑* + *ɣi*)

(sub. cl. pref.) (neg. pref.) 'sweep' (neg. perf. suff.) (neg. suff.)

The fact that there is no ↑ in the verbs above even though they contain low-toned verb radicals and suffixes can be accounted for by means of the following rule:[22]

(3.5-2) ↑-Deletion.

$$\underset{\begin{bmatrix}-\text{SUBJ}\\ +\text{SUB CL}\end{bmatrix}}{{}_{V}[\ldots\ \uparrow\ \ldots]}$$

s.d. 1 2 3

s.c. Delete 2.

This rule deletes any ↑ which would otherwise appear inside a subordinate clause [-SUBJ] verb (where the feature [-SUBJ] indicates that the verb has no overt subject, its subject being a bound variable.) The fact that there is a special rule which applies to this verb form provides additional evidence for the features [±SUB CL] and [±SUBJ], which distinguish this verb from all others. The reader will recall that these features also play a role in accounting for the distribution of the suffixal ↓ which appears at the end of about half the verb forms of Igbo.

3.6 Summary. In summary, I have argued here for the following five rules which apply to lexical verbal categories:

(3.6-1) Verb-final Tone Marker Insertion (3.1-1)

$[+\text{tone}]\ \ldots\ ]_V$

s.d. 1 2

s.c. Copy 1 after 2.

Condition: $2 \neq \emptyset$

(3.6-2) Negative ↓ Shift (3.2-1)

${}_V[\ldots[+\text{tone}][+\text{syll}]\ \downarrow\ \sigma$

s.d. 1 2 3 4 5

s.c. Move 4 to the right of 5.

(3.6-3) Before-low ↓ Insertion (3.3-9)

$\begin{bmatrix} +\text{V} \\ -\text{N} \\ +\text{LEX} \end{bmatrix} [\ \sigma\ (\uparrow)\ \ldots \uparrow$

s.d. 1 2 3 4

s.c. Substitute a ↓ for 2.

Condition: $3 \neq \emptyset$.

(3.6-4) Imperative ↑ Insertion (3.4-2)

$\begin{bmatrix} \text{V} \\ \text{IMP} \end{bmatrix} [\ \sigma\ (\sigma\ \ldots)]$

s.d. 1 2 3

s.c. Insert a ↑ after 1.

(3.6-5) ↑-Deletion (3.5-2)

$$\underset{\begin{bmatrix}+\text{SUB CL}\\-\text{SUBJ}\end{bmatrix}}{\text{V}}\ [\ \ldots\ \uparrow\ \ldots\ ]$$

s.d. 1 2 3

s.c. Delete 2.

Given the assumptions which we have made about the tonal properties of the morphemes which make up an Igbo verb, these five rules correctly account for the internal tone contours of the eighteen tonally and/or morphologically distinct verb forms of Igbo. These rules may be assumed to apply at the lexical level, before the verb combines with other elements to form a syntactic phrase. In fact, there is some evidence that they MUST apply at a pre-syntactic level, for if the suffixal ↓ is to block the application of Verb-final Tone Marker Insertion to the verb forms in which it appears, then it must still be present in the verb when that rule applies; thus the rule of Verb-final Tone Marker Insertion must apply before the syntactic rule of ↓-Cliticization.

There is no need to assume any ordering among the lexical rules themselves, for the correct output will be obtained in every case if these five rules are allowed to apply simultaneously with one another. (However, the application of Before-low ↑ Insertion at the STEM level must precede the application of itself or any other rule at the word-level.) The correct output will also be obtained in every case if the rules are applied in sequence, with the rule of Verb-final Tone Marker Insertion ordered before Negative ↓ Shift.

4. A Comparison of the Present Analysis with that Proposed by Goldsmith (1976)

Compare the analysis of the Igbo verb forms which has been proposed here with that proposed by Goldsmith (1976). Goldsmith, following an approach previously taken by McCawley (1970), Leben (1973), and Williams (1976), proposes to generate the characteristic tone contour of each verb form by means of a "tone formula" for that verb form. By way of illustration, Goldsmith's tone formulas for the affirmative conditional, affirmative main clause completive, affirmative main clause incompletive, and general negative forms are shown below:

(4-1)

	Verb Form	Tone Formula		
		prefix tone	stem tone	suffix tone
a.	Affirmative Conditional	---	B	H
b.	Affirmative Completive [-SC]	---	L	---
c.	Affirmative Incompletive [-SC]	B^{-}	B^{*}	H
d.	General Negative [-SC]	H	B^{*}	---

The formulas above provide a tone for the verb prefix (if any), a tone for the verb "stem" (=first verb radical), and in those verb forms which induce a tone change in the following nominal constituent, a high suffix tone. (This high suffix tone corresponds to the suffixal ↓ which we have posited in these same verb forms. Following the analysis proposed by Williams (1976), Goldsmith uses this high suffix tone both to give high tone to toneless suffixal elements in these verb forms and as a "trigger" for the changes from lexical tone which occur in the nominal phrase which follows the verb.[23])

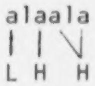
The symbols "B", "B^{-}", and "B^{*}", which occur in some of the tone formulas, are to be interpreted as follows:

(4-2) $$B = \begin{bmatrix}\alpha\text{high}\\ \beta\text{low}\end{bmatrix} \qquad B^{-} = \begin{bmatrix}-\alpha\text{high}\\ -\beta\text{low}\end{bmatrix} \qquad B^{*} = \begin{bmatrix}-\text{high}\\ \beta\text{low}\end{bmatrix}$$

where the lexical tone specification of the first verb radical of the verb is $\begin{bmatrix}\alpha\text{high}\\ \beta\text{low}\end{bmatrix}$.

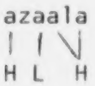
To give a specific example, the tone formula "$\underset{B^{-}}{\text{PREF}}\ \ \underset{B^{*}}{\text{STEM}}\ \ \underset{H}{\text{SUFF}}$", which is the formula for the affirmative incompletive form, means that the first verb radical of the verb will have downstepped high tone ($\begin{bmatrix}-\text{high}\\ -\text{low}\end{bmatrix}$) if it is lexically high-toned, and low tone ($\begin{bmatrix}-\text{high}\\ +\text{low}\end{bmatrix}$) if it is lexically low-toned. The tone of the suffixes will be high, and the prefix will have the opposite tone from the lexical tone of the first verb radical; in other words, it will have high tone before a low-toned verb radical and low tone before a high-toned verb radical. The tone melody which is derived by means of the tone formula is mapped onto the verb in a one-tone-per-syllable fashion, beginning at the beginning of the verb and working towards the right, as in the examples below:

(4-3) a. With the high-toned verb radical 'la'



'have left'

b. With the low-toned verb radical 'za'



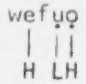
'have swept'

In comparing Goldsmith's analysis with the analysis which has been proposed here, I will concentrate first on the notion of a "tone formula", keeping this feature of his analysis separate from the question of whether the verb forms of Igbo are better analyzed in terms of level or dynamic tones.

With regard to the use of tone formulas to define the characteristic tone melodies of the verb forms, we may note, first of all, that an analysis along these lines is very complex, for it will be necessary to include in the grammar at least eighteen tone formulas altogether[24] -- one for each tonally and/or morphologically-dinstinct verb form. Furthermore, many of the tone formulas (those involving B^*'s and $\bar{B}$'s) are rules of a rather complex sort.

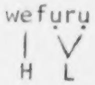
However, that is not the end of it, for the tone formulas of (4-1) (and those which would be given for the other fourteen verb forms) in fact account only for verbs in which there is no low-toned verb radical or suffix beyond the first verb radical; verbs which contain low-toned elements in non-initial position have distinct tone contours in all verb forms. For example, the compound verb *we↓fụ↑* 'take away', which is made up of the two low-toned verb radicals *we↑* 'pick up' and *fụ↑* 'go out' does not follow the tone formulas of (4-1), but instead uses the tone melodies shown below:

(4-3) a. Affirmative conditional.



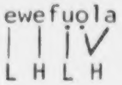
'take away' (conditional form)

b. Affirmative completive.



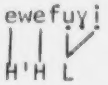
'took away'

(4.3) c. Affirmative incompletive.



'has taken away'

d. General negative.



'didn't take away'

Verbs with low-toned elements in non-initial position differ in two ways from verbs which do not contain such elements. First, low-toned verb radicals and suffixes are toned elements, which contribute an extra low tone segment to the tone contour. Secondly, by the rule which I have called "Before-low ↓ Insertion", the tone of the first verb radical is raised to high in cases where we would otherwise expect to find low. For example, the affirmative completive form (4-3 b) begins with a high tone even though the first verb radical, *we*, is lexically low-toned, and even though the tone formula for this verb form ((4-1 b)) specifies a low stem tone.

Notice that it is not possible to account for the tone melodies of verbs of this sort simply by adding a few rules to the tone formulas. For example, we might try to account for the tone melodies of (4-3) by adding the two rules below;

(4-4) a. If the verb contains a low-toned verb radical or suffix in non-stem position, then add a low suffix tone.

b. Raise the stem tone of such a verb to high.

The problem is that these rules can not consistently be applied either before or after the tone formulas. For example, if rule (b) applied BEFORE the tone formulas, then the wrong result would be obtained for the affirmative completive verb *wefụrụ* (4-3 b),
H L
because rule (b) would change the lexical tone of the verb radical *we* to high, but the tone formula for this verb form
L
(4-1 b) would re-assign a low stem tone. On the other hand, if rule (b) applied AFTER the tone formulas, then we would obtain the wrong result for the general negative form *ewefụɣị* (4-3 d),
H'H L
because the tone formula for this verb form (4-1 d) would assign a low stem tone and rule (b) would then incorrectly change that low stem tone to high (rather than to downstepped high).[25]

Since it appears to be impossible to account for the special tonal properties of verbs like *wefụ* by adding rules to the tone formulas, we have no choice but to add an additional, alternative tone formula for each verb form, the alternate tone formula to apply just in case the verb contains a member of the "low-toned" class in non-stem position. The alternative tone formulas for the four verb forms of (4-1) are given below:

(4-5) Tone formulas for verbs which have a low-toned element in non-initial position.

	Prefix tone	Stem tone	Suffix tone
Aff. conditional	---	H	LH
Aff. completive	---	H	L
Aff. incompletive	L	H	LH
Gen. negative	H	'H	L

The tone formulas above correctly predict the tone melodies of verbs like *wefụ* for these four verb forms. However, to make the analysis complete, we will have to add an alternative tone formula for verbs of this class for each of the eighteen verb forms of Igbo, making a total of thirty-six tone formulas in all.

The complexity of this analysis arises from the fact that it treats the characteristic tone contour of each verb form as an isolated, arbitrarily-chosen unit, thereby failing to take advantage of the many similarities in the tone contours of related verb forms. This disregard of the regularities in the system is not necessary even in a level-tone theory, for it is possible to account for the characteristic tone contours of the verb forms by means of a set of rules like that given in (4-7) below, based on the following assumptions about the lexical tone of the morphemes which make up a verb:

(4-6) a. There are three verb-form prefixes:

$\begin{bmatrix} \text{i/ị} \\ \text{H} \end{bmatrix}$: affirmative infinitive

$\begin{bmatrix} \text{a/e} \\ \text{H} \end{bmatrix}$: negative non-consecutive

$\begin{bmatrix} \text{a/e} \\ \text{L} \end{bmatrix}$: affirmative incompletive

(4.6) b. There is a floating high tone before a subordinate-clause verb.

c. There is a floating high-tone suffix at the end of those verb forms which induce changes in the lexical tone of a nominal constituent following the verb.

d. Verb radicals such as $\underset{\text{H}}{\textit{la}}$ 'leave' and $\underset{\text{L}}{\textit{fe}}$ 'cross' have lexically-assigned high or low tone.

e. Verb suffixes such as *ɣi* (neg) and $\underset{\text{L}}{\textit{be}}$ (neg. perfective) are either low-toned or toneless.

Verb-radicals in non-initial position within the verb stem count as suffixes. Suffixes derived from high-toned verb radicals are toneless; suffixes derived from low-toned verb radicals retain their low tone.

Given the above assumptions about the lexical tone of the morphemes which make up a verb, we can account for the characteristic internal tone contours of the various verb forms by means of the five ordered rules which appear below:

(4-7)

a. $[+\text{tone}] \rightarrow [+\text{low}] \;/\; {}_{V}[\;\_\_\_$

Condition: This rule applies in the affirmative imperative, affirmative completive and negative consecutive forms only.

b. $[+\text{tone}] \rightarrow [+\text{high}] \;/\; \begin{bmatrix} +\text{V} \\ -\text{N} \\ +\text{LEX} \end{bmatrix} [\;\_\_\_[+\text{low}]$

c. $\emptyset \rightarrow [+\text{low}] \;/\; {}_{V}[\;\_\_\_$

Condition: This rule applies in the negative subordinate clause and negative-main-clause-with-pronominal-subject forms only.

d. $[+\text{tone}] \rightarrow [-\text{low}] \;/\; {}_{\substack{V \\ \left[\begin{smallmatrix} +\text{SUB CL} \\ -\text{SUBJ} \end{smallmatrix}\right]}}[\;\ldots\;\_\_\_\;\ldots\;]$

e. Associate the tone segments with the syllables of the verb in a one-tone-per-syllable fashion, beginning from the beginning of the verb.

Rule (a) above lowers the first tone segment of the verb in the affirmative imperative, affirmative completive, and affirmative consecutive verb forms. This rule corresponds to the dynamic-tone rule of Imperative-↑ Insertion; it also accounts for the low tone of two verb forms -- the affirmative completive and the negative consecutive -- whose low tone was accounted for in the dynamic-tone analysis by positing a prefixal ↑ at the beginning of the verb.

Rule (b) raises the first tone segment of a verb or verb stem if the following tone segment is a L. This rule corresponds to the dynamic-tone rule of Before-low ↓ Insertion.

Rule (c) introduces a low tone at the beginning of a negative subordinate clause verb or at the beginning of a negative main clause verb which is marked for a pronominal subject. By introducing an extra tone segment at the beginning of the tone melody, this rule causes the rest of the tone melody to shift one syllable to the right. Thus this rule corresponds to the dynamic-tone rule of Negative ↓ Shift.

Rule (d) raises any low tone segment inside the verb of a subordinate clause [-SUBJ] form. This rule corresponds to the dynamic-tone rule of ↑-Deletion.

Finally, rule (e) associates the tone segment of the tone melody with the syllables of the verb. In those verb forms which lack a high suffix tone, this rule spreads the tone of the last toned element of the verb onto the string of syllables at the end of the verb, thereby mirroring the dynamic-tone rule of Verb-final Tone Marker Insertion.

The derivations of representative verbs in three verb forms are shown below:

(4-8) a. The affirmative Incompletive form.

alaala L H H	azaala L L H	Underlying form
	H	Rule (b)
alaala | | V L H H	azaala | | V H L H	Rule (e)

(4-8) b. The Affirmative Completive form.

lara H	zara L	Underlying form
L		Rule (a)
lara L	zara L	Rule (e)

c. The Negative Consecutive form.

laɣị H	zaɣị L	Underlying form
L		Rule (a)
laɣị L	zaɣị L	Rule (e)

For the negative and subordinate clause forms, additional rules are needed to account for the downstepped high tone of the verb stem in cases where the rules of (4-6) predict high. However, it is not necessary to introduce new rules for this purpose, because the two rules which we introduced in Chapter II to account for the tone change in the constituent to the right of the associative morpheme will also serve our purpose here. These rules are repeated below:

(4-9) a. $[+\text{tone}] \rightarrow [-\text{high}] \;/\; [\text{H}]_{\text{Af}} \;(\#\#)\; \left(\begin{matrix}\text{V}\\ [+\text{tone}]\end{matrix}\right) \;\underline{\quad\quad}$

b. $[+\text{low}] \rightarrow \emptyset \;/\; [\text{H}]_{\text{Af}} \;\;(\#\#)\;\; \underline{\overset{\text{V}}{|}}$.

Let us assume that these rules apply not only in the environment of the associative morpheme, but also after the negative prefix $\begin{bmatrix}\text{a}\\ \text{H}\end{bmatrix}$ and the floating high tone which we have posited before a subordinate clause verb (See (4-6c)). In this way we obtain the derivation shown below:

(4-10) The Negative Main Clause Statement Form

alayị H H	azayị H L	Underlying form
alayị H H	azayị H L	Rule (4-7e)
'H		Rule (4-9a)

The Affirmative Completive Sub. Cl. [-SUBJ] Form

lara Ⓗ H H	zara Ⓗ L H	Underlying form (the Ⓗ is the floating high tone which precedes a subordinate clause verb.)
	'H	Rule (4-7d)
lara Ⓗ H H	zara Ⓗ 'H H	Rule (4-7e)
'H		Rule (4-9a)

The Negative Sub. Cl. [+SUBJ] Form

alayị azayị Ⓗ H H Ⓗ H L	Underlying form
L L	Rule (4-7c)
alayị azayị Ⓗ L H H Ⓗ L H L	Rule (4-7e)
'H 'H 'H	Rule (4-9a)
Ø Ø	Rule (4-9b)
alayị azayị Ⓗ 'H 'H Ⓗ 'H L	Output

Notice that in the above derivation of *alaɣị* we have had to assume that the high tone segment of the negative prefix $\begin{bmatrix} a \\ H \end{bmatrix}$ retains its affixal status (and thus its ability to trigger rule (4-9a)) even after rule (4-7e) has applied to map it onto the verb radical *la*.

The comparative simplicity of this rule-based analysis of the Igbo verb forms as compared with Goldsmith's tone-formula analysis is obvious; by taking advantage of the similarities among the characteristic tone contours of the various verb forms, we have been able to replace thirty-six tone formulas with just four new rules. What is more important, however, is the fact that a system of rules, subject to the Simplicity Criterion, tells us WHY THE SIMILARITIES ARE THERE, for the more similarities there are, the simpler the rules will be, and the higher will be the value of the grammar. In contrast, when the characteristic tone contours of the verb forms are defined by means of tone formulas, similarities among the verb forms appear to be accidental, for a grammar in which such similarities exist is no simpler than one in which they do not. The conclusion is inescapable, I think, that the characteristic tone contours of the Igbo verb forms should be defined by means of rules, and not by means of tone formulas.

Having concluded that even in a level-tone theory the tone contours of the Igbo verb forms should be defined by means of rules, we may now return to the question we put aside at the beginning of this section -- namely, whether those rules are better stated within a level-tone or a dynamic-tone theory. There are several good reasons for preferring a dynamic-tone approach.

First of all, as we have seen, the dynamic-tone approach allows a simpler statement of the lexical properties of verbal morphemes, for in the dynamic-tone analysis, verb radicals like *la* 'leave' can be analyzed as toneless whether they occur in stem-initial position (e.g. *laga* 'escape') or not (*we↑la* 'take home'). In contrast, in a level-tone analysis, verb radicals of this class must be analyzed as high-toned when they occur in stem-initial position, but as toneless when they do not. This is in contrast to low-toned verb radicals, which maintain their low tone whatever position they occupy within the verb.

Secondly, a level-tone analysis like the one which is outlined in (4-6) and (4-7) above requires rules which affect arbitrary sets of verb forms. For example, rule (4-7a) lowers the first syllable of an affirmative imperative, affirmative completive non-consecutive, or negative consecutive verb. But there is no reason why this particular set of verb forms should undergo a rule which does not apply to the other verb forms. This problem does not arise in the dynamic-tone analysis, because the rule of Imperative ↑ Insertion (which corresponds to the level-tone rule (4-7a)) applies to only one verb form -- the affirmative imperative. (In this analysis, the low tone of the affirmative completive and negative consecutive forms is accounted for in a different way -- by positing a prefixal ↑ at the beginning of the verb.)

Another example of the same sort is the level-tone rule (4-7c), which introduces a low tone segment at the beginning of a negative subordinate clause or question form, thereby accounting for the fact that the usual negative tone contour is shifted one step to the right in these forms. There is no principled reason why this rule should apply just to these two negative forms. The same is not true, however, in the dynamic-tone analysis, for the rule of Negative ↓ Shift (3.6-3), which corresponds to rule (4-7c), applies to any verb which begins with the configuration "[+tone]V↓...". The dynamic-tone analysis provides a principled basis for the patterning of these two verb forms together with respect to this rule, for these are the only verb forms in the language with this initial configuration.

The level-tone rule (4-7c) which accounts for the rightward shift of the tone contour in the negative subordinate clause and negative question forms is also problematic in another way, for this rule gives the wrong output for verbs like *tụbha* 'throw out',
H L
which have a low-toned morpheme in non-initial position. For example, in the negative question form, this verb must have the underlying representation shown below:

```
(4-11)  atụbhaɣị

        H H  L
```

Rule (4-7c) then applies, introducing an additional low tone segment at the beginning of the verb, and the whole tone melody is mapped onto the syllables of the verb as shown in (4-12):

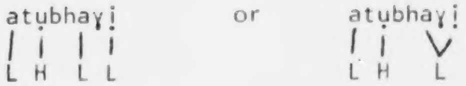
```
(4-12)  atụbhaɣị
        | |  | |
        L H  H L
```

Finally, rule (4-9b) applies to lower the second H to 'H giving the following output, which is incorrect:

```
(4-13)  *atụbhaɣị
         L H 'H L
```

An additional rule of some kind will be needed to produce the correct output.

(4-14)

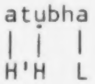


It is not easy to see how such a rule might be stated, for although (4-13) could easily be converted to (4-14) by means of the rule

(4-15) 'H → L / H ____ L

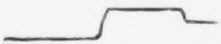
this rule could not be a general rule of the grammar, for it does not apply in the negative statement form

(4-16)



A more promising approach, I believe, would be to make verbs like *tụbha* exceptions to rule (4-7c). The output form (4-14) could then be derived from the underlying form (4-11) by means of a rule lowering the prefix tone in the verb of a question. Such a rule is apparently needed anyway, to account for the low tone of the prefix in the question

(4-17)

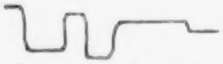


H̃a azaala ama? 'Have they swept the path?'

(repeated from (3.3-11b))

Recall that the prefix of this verb should have been raised to high by rule (4-7b), which makes the prefix tone high when the first verb radical is low-toned. Note that rule (4-7b) DOES apply in the following statement form which corresponds to (4-17):

(4-18)

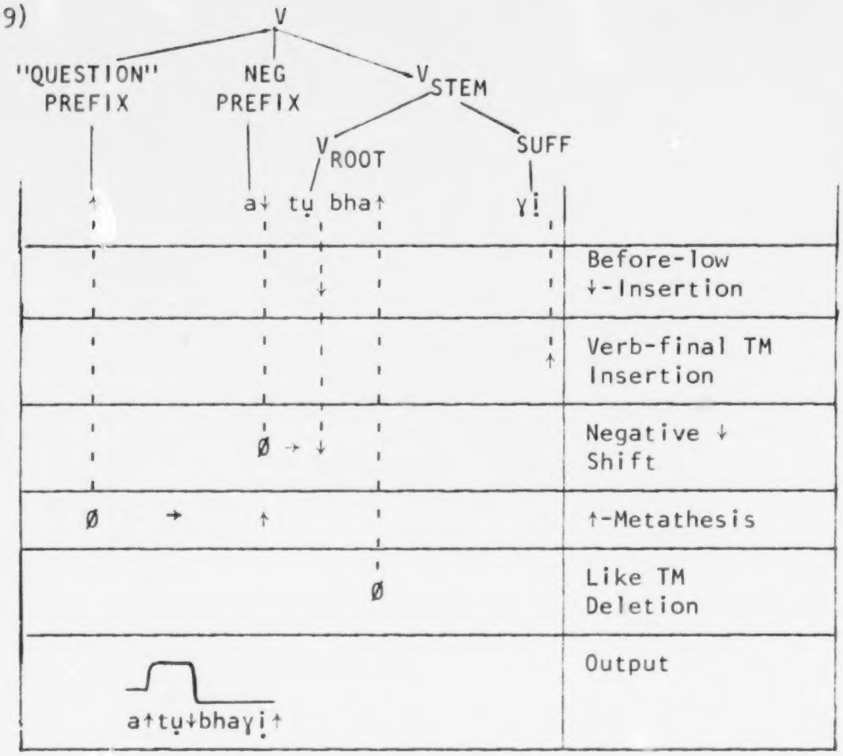


Ogu azaala ama. 'Ogu has swept the path.'

(repeated from (3-3.9))

Why, then, does the prefix have low tone in (4-17)? If the low prefix tone of (4-17) is accounted for by the addition of a rule lowering the tone of the prefix in a question, then this rule will also account for the low tone of the prefix in the negative question form of (4-14). To reach this solution, however, we have had to introduce one new rule, and introduce a class of exceptions to another. No such complications arise within the dynamic-tone analysis, where the tone contour of the question form a/tụ\bha is accounted for by completely regular rules, as shown below:

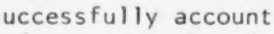
(4-19)


V
"QUESTION" PREFIX
NEG PREFIX
V_{STEM}
V_{ROOT}
SUFF
↑
a↓ tụ bha↑
γị
Before-low ↓-Insertion
↓
Verb-final TM Insertion
↑
Negative ↓ Shift
Ø → ↓
↑-Metathesis
Ø → ↑
Like TM Deletion
Ø
Output
a↑tụ↓bhaγị↑

The dynamic-tone account of the low tone of the verb prefix in (4-17) will be found in section 3.3, in connection with the first occurrence of this example (3.3-11b).

A fourth inadequacy in the level-tone approach -- in my opinion the most serious -- is its inability to provide a principled account of the clustering of certain properties in certain verb forms. To see that this is so, we must begin by observing that the level-tone analysis which is outlined above in (4-7) and (4-8) and Goldsmith's own tone-formula analysis both account only for the INTERNAL TONE CONTOUR OF THE VERB ITSELF and not for the tone changes which occur in the subject of the clause in some verb forms. For example, rule (4-7a), which lowers the first tone segment of a negative consecutive verb, successfully accounts for the low tone of the verb itself in this verb form. However, it does not account for the lowering of the string of high tones at the end of the subject, as in the example

(4-20)



Ekwe mechiγi aγ̌a 'but Ekwe didn't shut his eyes'

(repeated from (3.1-4b))

This puzzling fact about the negative consecutive verb form must be accounted for by another rule, independent of rule (4-7 a).

In contrast, in the dynamic-tone analysis, the lowering of the high-toned subject *Ekwe*↓ in this example is accomplished by the rule of Left Streamlining, which deletes the ↓ of *Ekwe*↓ in the environment of the prefixal ↑ at the beginning of the verb. The same prefixal ↑ also accounts for the low tone of the verb itself, for when there is no low-toned verb radical or suffix within the verb, it is the prefixal ↑ which is copied at the end of the verb by the rule of Verb-final Tone Marker Insertion. Thus both the unusual tonal properties of this verb form -- the invariably low tone of the verb itself and the lowering of a string of high-toned syllables at the end of the subject -- arise from a single underlying property, the fact that it has a prefixal ↑.

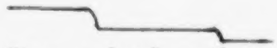
The "question" forms provide another similar example. In the dynamic-tone analysis which has been proposed here, the postulation of a prefixal ↑ at the beginning of these verb forms is sufficient to account for three unusual tonal properties which they exhibit: (i) that a high-toned subject like *ha*↓ 'they' (4-17) is lowered before the verb, (ii) that the negative question form undergoes Negative ↓ Shift (as shown in (4-19)), and (iii) that there is no drop in pitch after the prefix vowel in an affirmative incompletive question form like ↑*aza*↑*ala*↓ (4-17), even though the first verb-radical is underlyingly low-toned.[26]

This is in contrast to the level-tone analyses which have been proposed, for in these analyses, as we have seen, the rightward shift of the tone contour in a negative question form like ↑*aza*↓*γị*↓ 'didn't sweep' (4-19) and the low tone of the prefix vowel in an affirmative question form like ↑*aza*↑*ala*↓ 'have swept' (4-17) must apparently be treated as quite independent facts. Furthermore, in an analysis along these lines, the lowering of the string of high-toned syllables at the end of the subject must be viewed as still a third independent fact, for there is nothing about the verb itself which predicts that it would have this effect on the word which precedes it. Their failure to provide a principled account of the converging of these three unusual tonal properties in the question verb forms is a serious, fundamental inadequacy in level-tone analyses of Igbo.

5. The "Main Clause" ↓

In addition to the five lexical rules which were introduced in section 3 to generate the internal tone contours of the Igbo verb forms, there is also one transformational rule which affects the tone contour of the verb. This rule applies in affirmative main clause statements, inserting a relational particle [↓] between the subject and the predicate. The drop in pitch which is the reflex of this particle can be seen between the subject and the predicate of the affirmative main clause statements below:

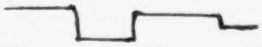
(5-1) a.



Ekwe ↓alaala a↓hya↓. 'Ekwe has left the market.'

(from *Ekwe*↓ + ↓ + *a*↑*laala* + ↓ + *ahya*↓)

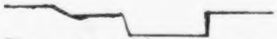
(relational particle) 'has left' (affirmative incompletive form) 'market'



b. Ekwe ↓aza↑ala a↓ma↓. 'Ekwe has swept the path.'

(from *Ekwe*↓ + ↓ + *a*↓*za*↑*ala* + ↓ + *ama*↓)

(relational particle) 'has swept' (affirmative incompletive form) 'path'



c. Ekwe ↓tụ↓bhara↑ ọnụ↓. 'Ekwe spoke.'

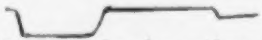
(from *Ekwe*↓ + ↓ + ↑*tụ*↓*bhara*↑ + *ọnụ*↓)

(relational particle) 'threw in' (affirmative completive form) 'mouth'

Example (c) above provides direct evidence for the main clause, for we would not ordinarily expect to find a drop in pitch between the high-toned subject *Ekwe*↓ and the verb *tụ*↓*bhara*↑ 'threw in', which also begins on a high tone level. (Compare, for example, the corresponding affirmative conditional form *Ekwe tụ*↓*bhara*↑ *ọ*↓*nụ*↓ 'if Ekwe speaks', in which there is no main clause ↓, and consequently no drop in pitch between the subject and the verb.)

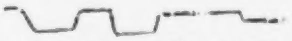
Examples (a) and (b) provide evidence of a less direct kind. Here the presence of the main clause ↓ between the subject and the predicate can be deduced from the fact that it has caused the deletion, by Right Streamlining, of the ↑ of the affirmative incompletive prefix *a*↑ in (a) and of the before-low ↓ which would otherwise appear after the prefix vowel in (b). These pitch-change markers do show up in the surface form in examples like those below, which correspond to (a) and (b) above except that the subject ends with a low-toned syllable. Note that there is no "main clause" between the subject and the verb when the subject ends on a low tone level.

(5-2) a.



O↓gu a↑laala a↓hya↓. 'Ogu has left the market.'

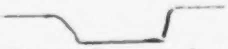
b.



O↓gu↑ a↓za↑ala a↓ma↓. 'Ogu has swept the path.'

A third argument for the existence of a relational particle [↓] between the subject and the predicate of an affirmative indicative main clause is based on an assumption which we made in sections 2 and 3 above -- namely that there is a prefixal ↑ at the beginning of an affirmative completive verb. This prefixal ↑ accounts for the fact that an affirmative completive verb has a ↑ for its verb-final tone marker even in cases like the following, in which there is no low-toned verb radical or suffix inside the verb:

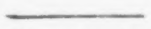
(5-3)



Ekwe↓ lara↑ ahya↓. 'Ekwe left the market.'

If we assume that the affirmative completive form, like most other verb forms, is marked by a prefix in the third prefix position, and that that prefix consists of a ↑ only, then the ↑ at the end of the verb *lara* in (5-3) can be accounted for in the normal way -- it is put there by the rule of Verb-final Tone Marker Insertion. However, there is a potential problem with this analysis, for this prefixal ↑ does not have the same effect on the tone of the preceding word as do the prefixal ↑'s which we have postulated for the negative consecutive and question forms. In those verb forms, the ↑ at the beginning of the verb causes the deletion, by Left Streamlining, of a ↓ at the end of the preceding word, as in the examples below:

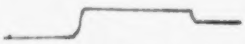
(5-4) a.



Ekwe layị↑ 'but Ekwe didn't leave'

(from *Ekwe↓ ## ↑layị↑*)

b.



H̄a a↑laala a↓hya↓? 'Have they left the market?'

(from *h̄a↓ ## ↑a↑laala + ↓ ## ahya↓*)

The affirmative completive clause of (5-3) stands in contrast to the clauses above, for in (5-3) the high-toned subject *Ekwe↓* is not lowered before the verb *↑lara↑*. How are we to account for this fact if there is indeed a prefixal ↑ at the beginning of this verb form?

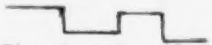
The fact that the subject is not lowered before the verb *↑lara↑* in (5-3) is accounted for by the main clause ↓ between the subject and the predicate of an affirmative main clause statement, for, assuming this particle, the clause of (5-3) will have the underlying structure

(5-5) Ekwe↓ # ↓ # ↑lara↑ ## ahya↓

Both the (underlined) main clause ↓ and the prefixal ↑ of the verb are deleted from this form by the rule of Right Streamlining, for each of these tone markers lies to the right of a ↓, separated from it by no more than a single word boundary. The ↓ at the end of *Ekwe↓* is left behind, and is the pitch drop which can be heard between the subject and the predicate in the surface form. Thus, by postulating a particle [↓] between the subject and the predicate of an affirmative completive main clause, we are able to account for the fact that a ↓ at the end of the subject is not deleted before the affirmative completive prefix ↑. This fact, then, gives us a third argument for the existence of the "main clause" ↓.

My final argument for the existence of the main clause ↓ is based on the realization of the drop in pitch between the subject and the verb of an affirmative main clause statement when the verb begins with a consonant. Let us first take note of the fact that in other verb forms a drop in pitch between the subject and a consonant-initial verb is realized as a sharp drop in pitch at the syllable boundary. Examples are given below from the affirmative conditional and subordinate clause completive forms. (The underlying representation which I assume for each clause is given beneath the surface form.)

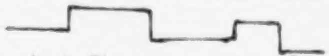
(5-6) a. Affirmative conditional form.



Ekwe↓ za↑ ụ↓lọ↑ 'If Ekwe sweeps the house'

(from *Ekwe↓ ## za↑ ## ụ↓lọ↑*)

b. Affirmative completive subordinate clause form.



mgbe↑ Ekwe↓ zara↑ ụ↓lọ↑ 'when Ekwe swept the house'

(from *mgbe↑ ## Ekwe↓ ## ↓zara↑ ## ụ↓lọ↑*)

The affirmative completive main clause form contrasts with the clause-types exemplified above in that a pitch drop between its subject and its verb is realized as a falling glide on the final syllable of the subject (like the associative ↓ of a proper name possessive). The unusual realization of a pitch drop between the subject and verb in this form is predicted by our analysis if we assume that this pitch drop is a relational particle, so that the clauses of (5-1c) and (5-3), for example, have the underlying structures shown below:

(5-7) a. Ekwe↓ # ↓ # ↑tụ↓bhara↑ ## ọnụ↓ (5-1c)

b. Ekwe↓ # ↓ # ↑lara↑ ## ahya↓ (5-3)

If the underlying representations given above are correct, then the final vowel of *Ekwe↓* meets the structural description of the rule of Syllable Lengthening, repeated below:

(5-8) [+syll][+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Lengthen 1.

The main clause ↓ and the prefixal ↑ of the verb are subsequently deleted by the rule of Right Streamlining, and, by the conventions for the realization of tone markers which we assumed for Igbo in Chapter II, the final ↓ of *Ekwe↓* is realized as a falling glide on the preceding syllable, for that syllable is long and falls within the same phonological word as the ↓.[27]

Having shown that there is a relational particle consisting of a ↓ only between the subject and the predicate of an affirmative indicative main clause statement, we may now state the rule for the insertion of that particle as follows:

(5-9) Main Clause ↓ Insertion.

$$[[\ldots\downarrow]_{NP}\ {}_{VP}[\ldots]]_{S}$$

$$\begin{bmatrix}-\text{SUB CL}\\+\text{IND}\\-\text{Q}\end{bmatrix}$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

This rule inserts the particle [↓] between the subject and the predicate of an indicative main clause whose subject ends with a

↓, provided that clause is neither a question nor a negative (as indicated by the feature [-Q]).

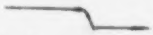
The rule of Main Clause ↓ Insertion, the lexical rules which were introduced in section 3, and the assumptions we have made about the tonal properties of the morphemes which make up an Igbo verb, together account for the characteristic tone contours of the verb forms of Igbo in all cases except those in which the subject of the verb is one of the cliticizing pronouns *m* 'I', *ị/i* 'you' (sg.), *ọ/o* 'he, she, it', or *a* (impersonal 'one'). An account of the grammatical and tonal properties of clauses containing these pronouns will be given in section 6 below.

6. The Cliticizing Subject Pronouns

The monosegmental subject pronouns *m* 'I', *ị/i* 'you' (sg.), *ọ/o* 'he, she, it' and *a* 'one' (impersonal) have certain special properties which will be accounted for in this section.

First of all, these pronouns undergo cliticization to the verb, as can be seen from the fact that they harmonize with the first verb radical of the verb just as other prefixal elements do. The effect of vowel harmony on the pronoun *ị/i* can be observed in the examples below, where this pronoun takes the form [i] if the vowel of the first verb radical is one of the [+ATR] vowels [i],[e],[u], or [o], and the form [ị] if it is one of the [-ATR] vowels [ị],[a],[ụ], or [ọ]:

(6-1) a.

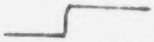


ị la a↓hya↓ 'if you leave the market'

(from *ị* + *la* + ↓ + *ahya↓*)

'you' (sg.) 'leave' (affirmative conditional form) 'market'

b.

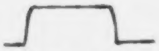


I vu↑ abọ↓? 'Were you carrying a basket?'

(from *i* + *↑vu↑* + *abọ↓*)

'you' 'carry' (affirmative completive question form) 'basket'

(6-1) c.

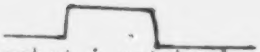


u↑we i↓ti↑ 'the clothes you were wearing'

(from *u↑we↓* + *i* + *ti↑*)

'clothes' 'you' 'wear'
(affirmative completive
sub. cl. form)

d.



mgbe↑ ị na↓akaala↑ 'since you've spoken'

(from *mgbe↑* + *ị* + *na↓a↑ka↑ala↑*)

'time' 'you' 'have spoken'
(affirmative incompletive
sub. cl. form)

Vowel harmony affects only the monosegmental subject pronouns which were listed at the beginning of this section; it does not affect the multi-segmental subject pronouns *gị↓* 'you' (sg.), *aỹị↓* 'we', *unu↓* 'you' (pl.) and *h̃a↓* 'they'.[28] If we assume that vowel-harmony is a word-internal process, then this difference between the monosegmental and multi-segmental subject pronouns suggests that only the former undergo cliticization to the verb. A rule for the cliticization of a monosegmental subject pronoun can be stated as follows:

(6-2) Pronoun Cliticization

$_{PRO}[[+seg]]_{PRO}\ \ _{V}[\ldots]_{V}$

s.d. 1 2

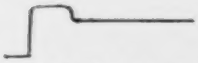
s.c. Chomsky-adjoin 1 to 2.

This rule cliticizes a monosegmental subject pronoun to the verb which follows it. (Note that there are no monosegmental pronouns except the subject pronouns which were listed at the beginning of this section.)

When the verb begins with a consonant, as in the examples of (6-1), the tone contour of the verb-plus-pronoun combination is predictable from the lexical tone contour of the verb alone. We may conclude, then, that the monosegmental pronouns themselves are toneless.

An additional rule is needed when the range of data is extended to include vowel-initial verb forms such as those exemplified below:

(6-3) a.

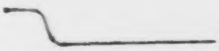


ọ↑la↓ɣị ahya↓ 'He didn't leave the market.'

(from *ọ* + *a↑la↓ɣị↓* + *ahya↓*)

'he' 'didn't leave' 'market'
(neg. main
clause form)

b.

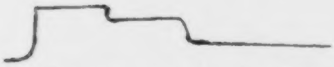


ka↓ o mechaala↑ 'after he had finished'

(from *ka↑* + *o* + *e↑mechaala↑*)

(complementizer) 'he' 'have finished'
(affirmative incompletive
sub. cl. form)

c.



m↑gbe ↓o me↓chiɣi aỹa↓ 'when he didn't shut his eyes'

(from *mgbe↑*+*o* + *↓eme↓chiɣi↓* + *aỹa↓*)

'time' 'he' (neg. sub. 'eyes'
cl. form)

In the examples above, the cliticizing pronoun *ọ/o* has replaced the initial vowel of the verb. That the pronoun vowel has REPLACED the prefix vowel and not simply caused its deletion can be seen from examples (b) and (c), in which the pronoun vowel has come to follow the subordinate clause ↓ within the verb.

The rule for the replacement of the prefix vowel by the pronoun vowel may be stated as follows:

(6-4) Prefix Vowel Replacement.

$_V[[+syll][+syll]$

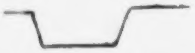
s.d. 1 2

s.c. Replace 2 with 1.

Note that this is a surface-level rule rather than a lexical rule, since it must follow the syntactic rule of Pronoun Cliticization.[29] Since this rule represents a purely phonological process, the presence of tone markers within the verb is immaterial, and need not be provided for in the structural description of the rule.

The two rules of Pronoun Cliticization and Prefix Vowel Replacement, plus the assumption that the citicizing pronouns are lexically toneless, correctly account for all the verb-pronoun combinations of (6-1) and (6-3). However, these two rules are not sufficient to account for the main-clause statement forms, for in these forms there is an unexpected ↓ between the cliticized pronoun and the verb stem. Examples are given below:

(6-5) a.

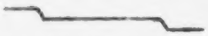


Ọ↓ lara↑ ahya↓. 'He left the market.'

(from *ọ* + *lara↑* + *ahya↓*)

'he' 'left' 'market'
(affirmative
completive
main clause
form)

b.



Ọ ↓laala a↓hya↓. 'He has left the market.'

(from *ọ↓* + *a↑laala* + ↓ + *ahya↓*)

'he' 'has left' 'market'
(affirmative
incompletive
main clause
form)

It is striking that there should be an unexpected ↓ between the cliticized subject pronoun and the verb stem in just those verb forms in which we have posited a "main clause" ↓. We can identify this unexpected ↓ with the main clause ↓ if we (i) re-state the rule of Main Clause ↓ Insertion in such a way that it will apply when the subject position is empty and (ii) add a rule of ↓-Metathesis to transpose the main clause ↓ with a following vowel when it is initial in a main clause. This rule may be stated as follows:

(6-6) Main Clause Tone Marker Metathesis

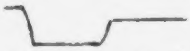
${}_{\substack{S\\ [-\text{SUB CL}]}}[[+\text{tone}][+\text{syll}]]$

s.d. 1 2

s.c. Move 1 to the right of 2.

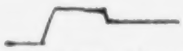
The derivation of the clause of (6-5a), following the outline above, is shown below:

(6-7)

$[[\underset{.}{o}]_{PRO}\ {}_{V}[\uparrow lara\uparrow]_{V}\ {}_{NP}[ahya\downarrow]_{NP}]_{S}$	Underlying form
$[_{V}\ \underset{.}{o}\ [_{V}\ [\uparrow lara\uparrow]_{V}\ ]_{V}$	Pronoun Cliticization
[↓]	Main Clause ↓ Insertion
0 ——— ↓	Main Clause Tone Marker Metathesis
 ọ↓lara↑ ahya↓	Output

I stated above that there is an unexpected ↓ after a cliticized subject pronoun in all the verb forms which have a main clause ↓. This statement is true in all cases except one: there is no ↓ after a cliticized subject pronoun in the affirmative incompletive consecutive form, though this is a verb form in which the main clause ↓ normally appears. Instead, a cliticizing pronoun in this verb form is followed by a ↑, as in the examples below:

(6-8) a.

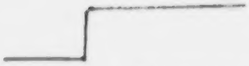


ọ ↑saa↓ ahụ↓ '(and then) he took a bath'

(from *ọ* + *a↑saa* + ↓ + *a↑hụ↓*)

'he' 'wash' (affirmative incompletive form) 'body'

(6-8) b.



ọ mụ↑ọ akwụkwọ↓ 'and then he studied'

(from *ọ* + *a↓mụ↑ọ* + ↓ + *akwụkwọ↓*)

'he' 'study' 'books'
(affirmative
incompletive
form)

Notice that there is no ↓ after the pronoun even in (b), where the first verb radical is low-toned, so that we would ordinarily expect the initial vowel of the verb to be followed by a Before-low ↓.

The invariably low tone of a cliticized subject pronoun in the affirmative consecutive form is most easily accounted for by means of a rule like the following, which substitutes an affixal ↑ for a "main clause" ↓ which is the first element of a consecutive clause:

(6-9) Consecutive ↑ Insertion

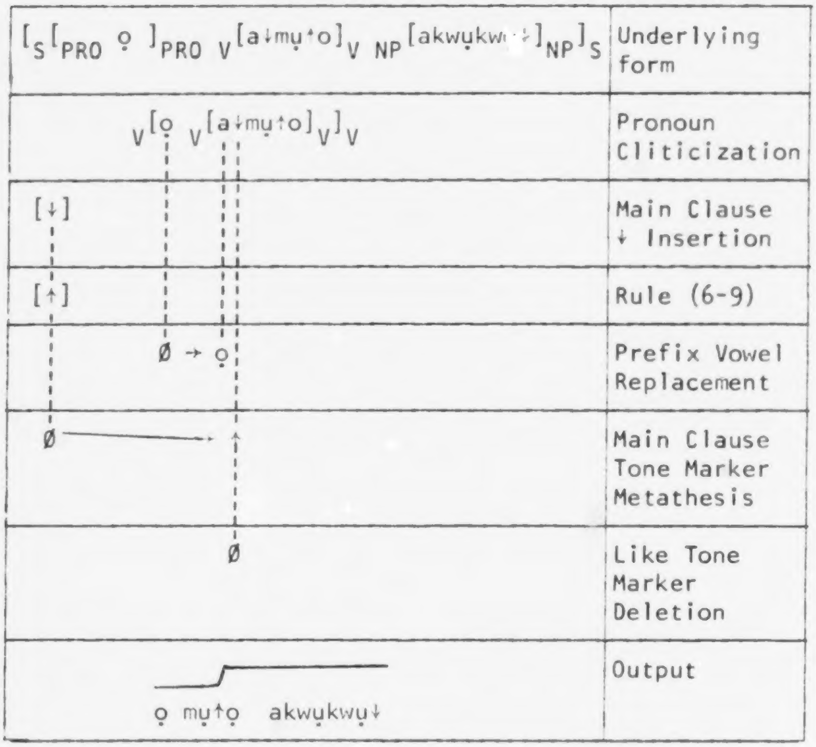
$_{S}[$ [↓]
[+CONSEC]

s.d. 1

s.c. Replace 1 with the particle [↑].

The ↑ which is inserted by rule (6-9) is subsequently moved to the right of the initial vowel of the verb by the rule of Main Clause Tone Marker Metathesis. Thus the clause of (6-8b) has the derivation below:[30]

(6-10)


[S[PRO ọ]PRO V[a↓mụ↑o]V NP[akwụkwụ↓]NP]S
Underlying form
V[ọ V[a↓mụ↑o]V]V
Pronoun Cliticization
[↓]
Main Clause ↓ Insertion
[↑]
Rule (6-9)
0 → ọ
Prefix Vowel Replacement
0
↑
Main Clause Tone Marker Metathesis
0
Like Tone Marker Deletion
ọ mụ↑ọ akwụkwụ↓
Output

The rules which have been introduced in the last two sections of this chapter are listed below in the order in which they apply:

(6-11) a. Pronoun Cliticization.

$[_{PRO}[+seg]]_{PRO}\ _{V}[\ldots]]_{V}$

s.d. 1 2

s.c. Adjoin 1 to the lefthand side of 2.

b. Main Clause ↓ Insertion.

$$\underset{\begin{bmatrix}-\text{SUB CL}\\ +\text{IND}\\ -\text{Q}\end{bmatrix}}{[_{S}}([\ldots\downarrow]_{NP})\ _{VP}[\ldots]]$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

(6-11) c. Consecutive ↑ Insertion.

$${}_{\underset{[+\text{CONSEC}]}{S}}[\qquad [\downarrow]$$

s.d. 1

s.c. Replace 1 with the morpheme [↑].

d. Prefix Vowel Replacement.

$${}_{.V}[[+\text{syll}][+\text{syll}]$$

s.d. 1 2

s.c. Replace 2 with 1.

e. Main Clause Tone Marker Metathesis.

$${}_{\underset{[-\text{SUB CL}]}{S}}[[[+\text{tone}][+\text{syll}]$$

s.d. 1 2

s.c. Move 1 to the right of 2.

A complete summary of the analysis which has been proposed here for Igbo will be given in the first section of Chapter VIII.

FOOTNOTES TO CHAPTER VII

[1] The names used to refer to the verb forms of Igbo differ widely from author to author. The names which will be used in this work are listed in the lefthand column in the chart below. The names used by Green and Igwe (1963) for the same verb forms are listed in the righthand column. Note that in some cases I am treating as a single verb form what Green and Igwe regard as two or three distinct verb forms.

THIS WORK	GREEN AND IGWE (1963)
AFFIRMATIVE VERB FORMS	
1. Infinitive	Infinitive
2. Imperative	Imperative
3. Conditional	SVF* I subordinate conditional
4. Incompletive main clause	SVF II main
5. Incompletive subordinate clause with subject	SVF II relative B, SVF II subordinate conditional
6. Incompletive subordinate clause without subject	SVF II relative A
7. Incompletive consecutive	SVF II main non-initiating, Participle
8. Incompletive question	SVF II question
9. Completive main clause	SVF I main
10. Completive subordinate clause with subject	SVF I relative B
11. Completive subordinate clause without subject	SVF I relative A
12. Completive consecutive	Narrative
13. Completive question	SVF I question
NEGATIVE VERB FORMS	
1. General negative (including infinitive, conditional, and main clause)	SVF I main SVF I subordinate conditional Infinitive, imperative
2. Subordinate clause with subject	SVF I relative B
3. Subordinate clause without subject	SVF I relative A
4. Question	Question
5. Consecutive	SVF II main non-initiating Narrative

* SVF = Subject verb form

Notes

[2] The data in this chapter is taken from Green and Igwe (1963), Igwe and Green (1970), and Welmers and Welmers (1968). I have sometimes simplified examples slightly or substituted one vocabulary item for another.

[3] What I am calling the verb "root" corresponds to that level of structure which Welmers (1970a) calls the verb "base".

[4] Note that the tone contour for this root is not a simple concatenation of the tone contours of the simple roots which make it up. The rule which inserts the ↓ after the first syllable of this root will be introduced in section 3.3 below.

[5] Both the analyses which have been suggested here predict a certain "mixing" of verb radicals and "true" suffixes in non-initial position in a verb root. This prediction is borne out in fact by verb roots like *we↓tafụ↑* 'bring more' (from *we↑* 'pick up' + *ta* (suffix indicating action toward speaker or subject) + *fụ↑* 'be more'), in which the verb radical *fụ↑* follows the true suffix *ta* within the verb root.

[6] I follow the usual notation here, marking nasality on the first segment of the syllable only, though it in fact extends throughout the syllable.

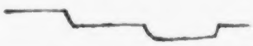
[7] In postulating a "stem" level of lexical structure intermediate between the root level and the word level, I am departing from the analysis of Welmers (1970a), who includes the suffixes of (2.2-1) in the class of "inflectional" affixes. However, these suffixes are not really inflectional, since, according to Green and Igwe (1963), they are not obligatorily present in any of the verb forms.

[8] The exclamatory tone of these examples is created by the absence of aspectual suffixes in the verb root.

[9] However, the completive-incompletive distinction seems to carry little semantic import in the consecutive form. Moreover, the completive consecutive form acts like an incompletive form in some ways. For example, it makes use of the "open vowel" suffix *a/e/ọ/o* (2.2-1e) and induces a pitch drop in the following nominal constituent -- two properties which generally characterize the incompletive forms rather than the completive one.

[10] However, see Goldsmith (1978) for evidence that Emond's root-nonroot distinction does play a role in the grammar of Igbo.

[11] There are also subordinate clause forms with an adversative reading; for example,

(i) 

...ŋkị↓ta ↓ataa↑ gị↓ 'lest the dog bite you'

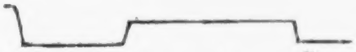
(from *ŋkị↓ta↓* + *↓a↑taa↑* + *gị↓*)

'dog' 'bite' 'you'
(affirmative
incompletive
subordinate
clause form)

The "missing" element in this clause is a conditional adverbial of some sort.

[12] This information about Twi and this suggestion for the characterization of a subordinate clause were given to me by G. N. Clements (personal communication).

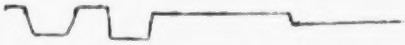
[13] A verb in the "question" form always has a pronoun for its grammatical subject. The identity of the subject is specified, if necessary, by means of a NP in topic position, as in the example below:

(ii) 

O↓gu ọ dị↑na ebe a↓hụ̃↑? 'Is Ogu there?'

(Lit., 'Ogu, he is in place that')

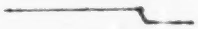
[14] Note that the nominal constituent which is affected in this way need not be the direct object of the verb. For example, it may be the indirect object, as in the example

(iii) 

A↓ỹị↑ e↓we↑taarala E↓kwe eɣu↓ 'We have brought Ekwe a goat.'

'we' 'have brought' 'goat'

or it may be an adverbial element, as in the example

(iv) 

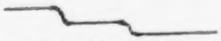
Ya byaa e↓ci↓ 'if he comes tomorrow'

(from *ya↓* + *byaa* + ↓ + *eci↓*)

'he' 'come' 'tomorrow'
(affirmative
conditional
form)

or it may be a predicate adjective, as in the example

(v)



ute↓ dị ↓mbara↓ 'a mat which is wide'

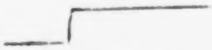
(from *ute↓* + *↓dị* + ↓ + *m↑bara↓*)

'mat' "is" 'wide'
(affirmative
completive
sub. cl. form)

[15]Additional evidence for this generalization of the rule of Left Streamlining will be given in section 3.2 below, in connection with the discussion of the "question" ↑.

[16]According to Green and Igwe (1963), there is an alternative, less emphatic negative consecutive form in which the verb is high-toned when it contains no low-toned verb radical or suffix. An example of this alternative negative consecutive form is given below:

(vi)

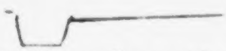


Ekwe↑ zụγị anụ↓ 'and Ekwe didn't buy meat'

Notice that the prefixal ↑ is still present at the beginning of the verb, for the high-toned subject of *Ekwe↓* is lowered before the verb. However, the rule of Verb-final Tone Marker Insertion has not copied the prefixal ↑ at the end of the verb. Apparently the ↑ between the subject and the predicate in this verb form is sometimes analyzed as a relational particle BEFORE the verb rather than as a prefix of the verb itself. In that case, there is no tone marker inside the verb and the rule of Verb-Final Tone Marker Insertion cannot apply. As a result, there is no tone marker at the end of the verb, and the verb must take the tone level of the following NP.

There is one other set of verbs in Igbo which provide no internal tone marker for the rule of Verb-final Tone Marker Insertion to copy -- namely, a set of affirmative completive main clause forms built around a small class of toneless verb radicals which fail to take the usual affirmative completive prefix "↑". In the Ọ↑ñụñụ↓ dialect described by Green and Igwe (1963), there are just two verb radicals *wụ* 'be' and *ka* 'surpass' which exhibit this behavior. However, in the dialect described by Swift, Ahaghotu, and Ugorji (1962) there are a number of verb roots which behave in this way, including *ri* 'eat', *ŋụ* 'drink', *sa* 'wash', and *ku* 'dip up (water)'. One of the authors of this study (Mr. Ahaghotu), treats affirmative completive main clause verbs built around these verb roots as toneless elements. In Mr. Ahaghotu's speech, a verb of this sort takes the tone level of the following word, as in the examples below:

(vii) a.

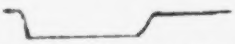


A↓ỹị↑ ŋụr̃ụ mmiĩ↓ 'We drank wine.'

(from *a↓ỹị↑* + *ŋụr̃ụ* + *mmiĩ↓*)

'we' 'drank' (affirmative completive main clause form) 'wine'

b.



A↓ŋụr̃ụ h̃a↑ mmiĩ↓ 'They drank wine.'

(from *a* + *ŋụr̃ụ* + *h̃a↑* + *mmiĩ↓*)

(subject position filler) 'drank' (affirmative completive main clause forms) 'they' 'wine'

(The subject pronoun *h̃a↑* 'they' is moved to a position following the verb in this dialect, and its underlying position before the verb is filled with the pronoun *a* 'one' (impersonal). (See Goldsmith (1978) for a discussion of this phenomenon.) The ↓ between the *a* and the verb *ŋụr̃ụ* will be accounted for in section 6 of this chapter.)

The behavior of verbs like *ŋụr̃ụ* in Mr. Ahaghotu's speech is easily accounted for in the analysis which has been presented here, for if these verbs do not take the prefixal ↑ which usually appears at the beginning of an affirmative completive verb, then there is no internal tone marker to be copied at the end of the verb by the rule of Verb-final Tone Marker Insertion, and the verb must take the tone level of the element which follows it.

Mr. Ugorji, the other Igbo author of this study, differs from Mr. Ahaghotu in that he gives high tone to verbs like *ŋụr̃ụ* whatever the tone of the element which follows the verb. Thus in Mr. Ugorji's speech, there is a drop in pitch between the end of the verb and the low-toned pronoun *h̃a↑* in (vii b). Apparently, Mr. Ugorji is using a different version of the rule of Verb-final Tone Marker Insertion -- one which inserts a ↓ at the end of the verb when there is no internal tone marker to be copied. Such an alternative version of the rule may be stated as follows:

(viii) $\langle\uparrow\rangle \; \ldots \;]_V$

s.d. $\quad 1 \quad 2$

s.c. Insert $\begin{bmatrix}+\text{tone}\\ \langle-\text{fall}\rangle\end{bmatrix}$ after 2.

Condition: $2 \neq \emptyset$

Stated in this way, the rule inserts a ↑ at the end of a verb whose last internal tone marker is a ↑, and a ↓ at the end of any other verb.

[17] The correlation between the tone level at the end of the verb and the presence of a suffixal element which affects the tone contour of the following nominal phrase was first observed by Edwin Williams (1976).

[18] It is not necessary to prevent this rule from applying to the subordinate clause [-SUBJ] forms, which also make use of the suffixal ↓, for a ↑ at the end of a verb in one of these forms would be deleted by the rule of ↑-Deletion, to be introduced in section 3.5 below.

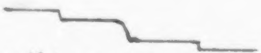
[19] Since a negative STATEMENT with pronominal subject also makes use of the "question" ↑, this form is in fact ambiguous between the question "Didn't they leave the market?" and the statement "They didn't leave the market." Whether the statement or the question is meant must be determined from context; however, the statement interpretation is more likely.

[20] As before, I am using the term "downstepped high" ('H) where Goldsmith himself uses the term "mid" (M).

[21] An equivalent level-tone rule could be stated as follows:

(ix) $[+\text{tone}] \rightarrow \begin{bmatrix}+\text{high}\\-\text{low}\end{bmatrix} \; / \; {}_V[_{\text{STEM}} \underline{\quad\quad} \; L$

[22] Apparently not all dialects of Igbo make use of this rule, for in the Welmers' *Learners' Manual*, subordinate clause [-SUBJ] forms have ↑'s in the usual places. For example,

(xii) 

ndị↓ na ↓abya↓beγi↑ 'those who have not yet come'

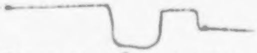
(from *ndị↓* + *na* + *↓a↑bya↓be↑γi↑*)

'people' (relative marker) 'have not yet come' (sub. clause [-SUBJ] form)

[23] The rules by which the high suffix tone effects changes in the lexical tone of the following constituent are repeated in (4-9) below. Note, however, that the application of these rules will have to be limited in some way so as to account for the fact that there is no change in the tone of the constituent following the verb if that constituent is not NOMINAL. (See the examples of (2.2-23).)

[24] Goldsmith himself lists only thirteen tone formulas, but his list does not include formulas for the affirmative question forms or for the consecutive forms.

[25] Nor would it be possible to simply change rule (b) so that it states "Raise the stem tone of the verb to downstepped high when there is a low suffix tone", for that rule would give the wrong output for the affirmative conditional form

(xiii) 

Ekwe we↓fụ↑ e↓go↓ 'if Ekwe takes away the money'

(from *Ekwe↓* + *we↓fụ↑* + *ego↓*)

'take away' 'money'
(affirmative
conditional
form)

[26] Specifically, the lowering of a high-toned subject before the verb is accomplished by the rule of Left Streamlining, which deletes a ↓ at the end of the subject in the environment of the ↑ at the beginning of the verb. The application of Negative ↓ Shift is also attributable to the presence of this prefixal ↑, for this rule applies to any verb with the tone shape $_{V}$[...[+tone]V↓...]. Finally, the prefixal ↑ blocks the insertion of a before-low ↓, for there is no provision for a tone marker at the beginning of the verb in the structural description of the rule of Before-low ↓ Insertion.

[27] This analysis depends on the assumption that the application of Right Streamlining to (5-7a) creates the output string

(xiv) Ekwe↓ # tụ↓bhara↑ ## ọnụ↓

with only a single # between the subject and the predicate. If the output of this rule were, instead,

(xv) Ekwe↓ $\underline{\#\#}$ tụ↓bhara↑ ## ọnụ↓

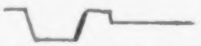
then the ↓ at the end of *Ekwe↓* would be (incorrectly) deleted by the rule of Like Tone Marker Deletion.

This assumption is, I believe, a reasonable one, since phonological boundaries in general behave like a kind of bracketing rather than like units of the phonological string. Thus one does not expect two SINGLE #'s to combine to create a double *##*. (See the discussion of phonological boundaries in Chapter VIII.)

[28] Some speakers give other tone contours to some of these pronouns. For example, the pronoun for 'we' sometimes has the tone contour *a↓ỹi̤↑* or *a↑ỹi̤↓*, the pronoun for 'you' (pl) is sometimes *u↓nu↑* and the pronoun *h̃a↓* 'they' takes the form *h̃a↑* in those dialects in which it is postposed to a postverbal position. (See example (viib) above.)

[29] However, there are facts which suggest that Pronoun Cliticization is not a syntactic rule after all. For example, consider the following affirmative conditional clause:

(xvi)



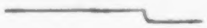
I↓ke'e ↓akwa↓ 'If you (sg.) share out eggs'

(from *i* + *ke↑e* + ↓ + *a↑kwa↓*)

'you' 'share out' (conditional form) 'eggs'

What needs accounting for here is the ↓ after the (toneless) cliticizing subject pronoun *i*. Note that the explanation given immediately below for the ↓ which follows a cliticized pronoun in the main clause forms does not apply in this case, for there is no "main clause" ↓ in a conditional clause, nor is there any ↓ after the subject pronoun in clauses like the following, where there is no low-toned morpheme inside the verb.

(xvii)



! laa a↓hya↓ 'if you leave the market'

(from *i* + *laa* + ↓ + *ahya↓*)

'you' 'leave' (conditional form) 'market'

If the cliticizing subject pronoun is assumed to be part of the LEXICAL verb (rather than adjoined to it by a syntactic rule) then these facts are no problem, for in that case the ↓ after *i* in (xvi) is placed there by the rule of Before Low ↓ Insertion.

[30] In writing out this derivation, I have omitted the suffixal ɨ which should appear at the end of the verb in the underlying form. This suffixal ɨ undergoes cliticization to the object NP (by the rule of ɨ-Cliticization), and is subsequently deleted by the rule of Nominal ɨ Deletion.

CHAPTER VIII

SOME REFLECTIONS ON THE TONE RULES OF IGBO

1. Four Rule-types, and Their Ordering in the Grammar

In the detailed analysis of Igbo which has been proposed in Chapters II, VI, and VII of this work, evidence has been given for the following rules, which are divided here into four components:

(1-1) Rules which apply to lexical categories

a. Verb-final Tone Marker Insertion[1] (VII.3.1-1)

$[+\text{tone}] \ \ldots \ ]_V$

s.d. 1 2

s.c. Copy 1 after 2.

Condition: $2 \neq \emptyset$

b. Negative ↓ Shift (VII.3.2-1)

${}_V[\ \ldots \ [+\text{tone}][+\text{syll}] \downarrow \sigma$

s.d. 1 2 3 4 5

s.c. Move 4 to the right of 5.

c. Before-low ↓ Insertion (VII.3.3-7)

${}_V[\ \sigma \ (\uparrow) \ \ldots \ \uparrow$

s.d. 1 2 3 4

s.c. Substitute a ↓ for 2.

Condition: $3 \neq \emptyset$.

(1-1) d. Imperative ↑ Insertion (VII.3.4-2)

$${}_{\underset{[+\text{IMP}]}{V}}[\ \sigma\ (\sigma\ \ldots\ )\ ]$$

s.d. 1 2 3

s.c. Insert a ↑ after 1.

e. ↑-Deletion (VII.3.5-2)

$${}_{\underset{\left[\begin{smallmatrix}+\text{SUB CL}\\ -\text{SUBJ}\end{smallmatrix}\right]}{V}}[\ \ldots\ \uparrow\ \ldots\ ]$$

s.d. 1 2 3

s.c. Delete 2.

(1-2) Syntactic Rules[2,3]

a. Pronoun Cliticization (VII.6-2)

$${}_{PRO}[[+\text{seg}]_{PRO}]\ {}_{V}[\ \ldots\ ]_{V}$$

s.d. 1 2

s.c. Chomsky-adjoin 1 to 2.

b. Main Clause ↓ Insertion (VII.5-9)

$${}_{\underset{\left[\begin{smallmatrix}-\text{SUB CL}\\ +\text{INDIC}\\ -\text{Q}\end{smallmatrix}\right]}{S}}[\ ([\ldots\downarrow]_{NP})\ {}_{VP}[\ldots]\ ]$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

c. Associative ↓ Insertion (VI.3-13)

$$[[\ \ldots\ ]_{[+N]}\ {}_{[-V]}[\ \ldots\ ]]$$

s.d. 1 2

s.c. Insert the morpheme [↓] betwen 1 and 2.

(1-2) d. Consecutive ↑ Insertion (VII.6-9)

$$\underset{[+\text{CONSEC}]}{{}_{S}[}[\downarrow]$$

s.d. 1

s.c. Replace 1 with the morpheme [↑].

e. ↓-Cliticization (VI.4-9)

$$[\;[\;\ldots\;]\begin{bmatrix}\langle +\text{N}\rangle_{a}\\ \langle -\text{AGENTIVE}\rangle_{b}\end{bmatrix}\;[\downarrow]\begin{bmatrix}+\text{N}\\ \langle +\text{PROPER}\rangle_{c}\\ \langle -\text{POSSESSIVE}\rangle_{d}\end{bmatrix}[\ldots]\,]$$

s.d. 1 2 3

s.c. Chomsky-adjoin 2 to 3.

Condition: $a \supset b$ and $c \supset d$.

(1-3) Phonological Rules Whose Domains are Defined in Terms of Syntactic Bracketing[4]

a. Prefix Vowel Replacement (VII.6.4)

$$_{V}[\;[+\text{syll}][+\text{syll}]$$

s.d. 1 2

s.c. Replace 2 with 1.

b. Main Clause Tone Marker Metathesis (VII.6-6)

$$\underset{[-\text{SUB CL}]}{{}_{S}[}[+\text{tone}][+\text{syll}]$$

s.d. 1 2

s.c. Move 1 to the right of 2.

c. Associative ↓ Deletion (VI.6.4-7)

$$[+\text{N}]^{[}\;\downarrow[+\text{syll}]\;\sigma\;\uparrow\;\ldots\;\downarrow$$

s.d. 1 2 3 4 5 6

s.c. Delete 1.

(1-3) d. ↓-Metathesis (VI.4-13)

$_{[+N]}[\downarrow[+\mathrm{syll}] \ \ldots \ \downarrow$

s.d. 1 2 3 4

s.c. Transpose 1 and 2.

e. Sandwiched ↓ Deletion (VI.6.3-6)

$_{[+N]}[\ ([+\mathrm{syll}])\ \downarrow\ \sigma\ \downarrow\ \sigma\ \downarrow\ ]$

s.d. 1 2 3 4 5 6

s.c. Delete 4.

f. Internal ↓ Deletion (VI.6.1-5)

$_{[+N]}[[+\mathrm{syll}]\ \downarrow\ \sigma\ \downarrow\ \ldots\ ]$

s.d. 1 2 3 4 5, where $5 \neq \emptyset$.

s.c. Delete 2.

Condition: This rule does not apply to the highest-level nominal phrase, $\overline{\mathrm{NP}}$.

(1-4) Phonological Rules Whose Domains are Defined in Terms of Phonological Boundaries[5]

a. Syllable Lengthening (II.3.3-9)

[+syll][+tone] (#) (#) ↓

s.d. 1 2 3 4 5

s.c. Make 1 long.

b. Syllable Shortening (II.3.3-9)

[+syll] (#) (#) [+syll]

s.d. 1 2 3 4

s.c. Make 1 short.

(1-4) c. Right Streamlining (VI.1-2 a)

```
     ↓ (#) ([+syll]) [+tone]
s.d.1  2      3         4
```

s.c. Delete 4.

d. ↑-Retraction (VI.1-5)

```
     σ σ ↑ (#) (#) ↓
s.d.1 2 3  4   5  6
```

s.c. Transpose 2 and 3.

Condition: If 4 and 5 are both present, then 2 is not long.

e. Left Streamlining (VII.3.1-5)

```
     σ [+tone] (#) (#)   [+tone]
s.d.1    2      3   4       5
```

s.c. Delete 2.

Condition: If 3 and 4 are both present, then 1 is not long.

f. Syllabic-nasal Raising (VI.1-8b)

```
     ## [+tone] ⎡+syll⎤ [+nas]
                ⎣+nas ⎦
s.d. 1    2       3      4
```

s.c. Transpose 2 and 3.

g. ↑-Metathesis (VII.3.3-5)

```
     ## ↑[+syll]
s.d. 1 2   3
```

s.c. Transpose 1 and 2.

h. Phrase-final ↓ Deletion (cptional) (II.3.2-9)

```
     ↓  $
s.d. 1  2
```

s.c. Delete 1.

(1-4) i. Like-Tone-Marker Deletion (II.3.2-3)

$$\begin{bmatrix}\text{+tone}\\ \langle\text{+fall}\rangle\end{bmatrix}^{\langle\#\#\rangle} \ \ldots \ \begin{bmatrix}\text{+tone}\\ \langle\text{+fall}\rangle\end{bmatrix} \ \ldots \ \$\$$$

s.d. 1 2 3 4 5 6

s.c. Delete 1.

j. ↓-Reduction (II.3.2-5)

$$\downarrow \ \ldots \ \downarrow \ \ldots \ \$\$$$

s.d. 1 2 3 4 5

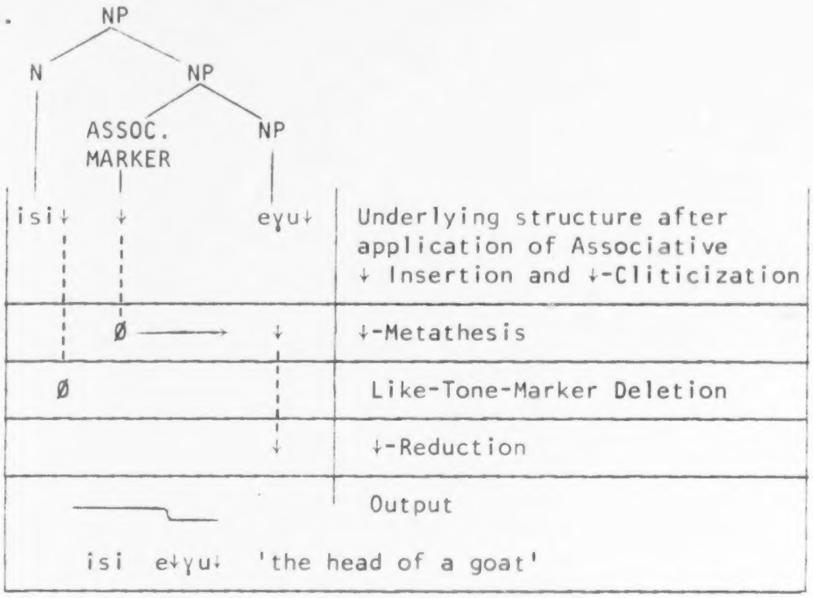
s.c. Reduce the magnitude of 1 by two thirds.

The rules above have been divided into four components, which are as follows: (1-1) lexical rules, (1-2) syntactic rules, (1-3) phonological rules whose domains are defined in terms of syntactic bracketing, and (1-4) phonological rules whose domains are defined in terms of phonological boundaries. I will now argue that each of these four rule-categories forms an identifiable component of the grammar, and that, insofar as rule-ordering can be ascertained, the rules of (1-1) apply before those of (1-2), which apply before those of (1-3), which in turn apply before those of (1-4).

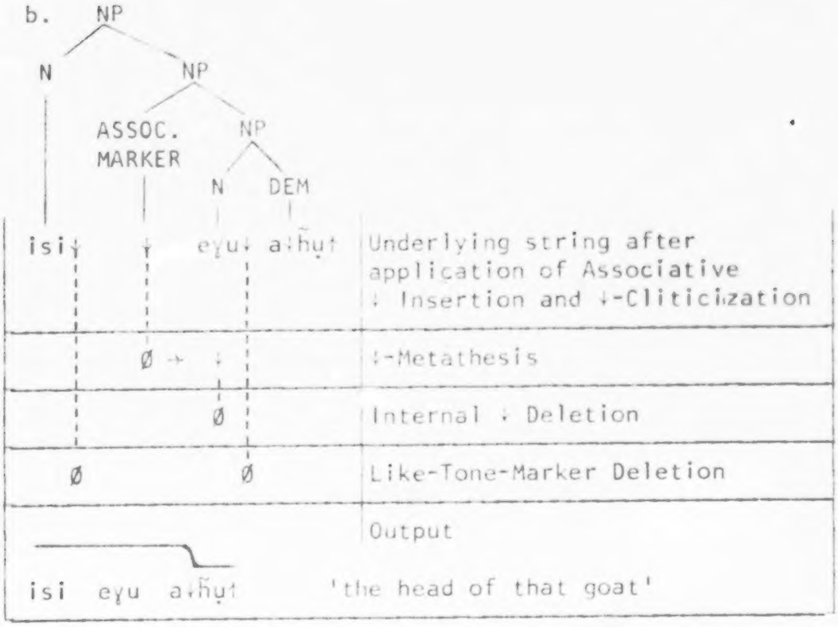
The rule ordering indicated above is at least clearly established in the case of the lexical rules of (1-1) vis-a-vis the syntactic rules of (1-2). My primary reason for listing the lexical rules together, as a separate component of the grammar, is the fact that in general these rules play a rather different role in the grammar from those phonological rules which apply to higher-level syntactic phrases, for it is only on those relatively rare occasions when verb radicals and affixes are combined to form a new verb that they can be said actually to function as RULES, which participate in a linguistic derivation. Their primary function is to give expression to certain generalizations about lexical items which are already familiar to native speakers of the language, and which are inserted into phrases as unit items, rather than being derived afresh with each use. Thus it seems reasonable to assume that even when new lexical items are created in conformance with these rules, they are created as independent items and inserted into larger phrases in finished form. One specific argument for this rule-ordering was pointed out in Chapter VII, section 3.1, where it was noted that the lexical rule of Verb-final Tone Marker Insertion must apply before the syntactic rule of ↓-Cliticization if the verb suffix "↓" is to block the application of Verb-final Tone Marker Insertion to the verb forms in which it appears. However, there are other plausible ways of accounting for the fact that those verb forms which are marked with a suffixal ↓ do not undergo Verb-final Tone Marker Insertion (see the alternative version of this rule in Chapter VII, (3.1-10)), and so the rule-ordering in this case is not altogether certain.

The ordering of the non-lexical phonological rules of (1-3) and (1-4) after the syntactic rules of (1-2) is more clearly established, for the syntactic rules of (1-2) consistently furnish the input for the phonological rules, but no phonological rule creates the input for a syntactic rule. For example, the syntactic rules of Associative ↓ Insertion and ↓-Cliticization create the input strings for the phonological rules of ↓-Metathesis, Associative ↓ Deletion, Internal ↓ Deletion, and Sandwiched ↓ Deletion, as shown in the derivations below:

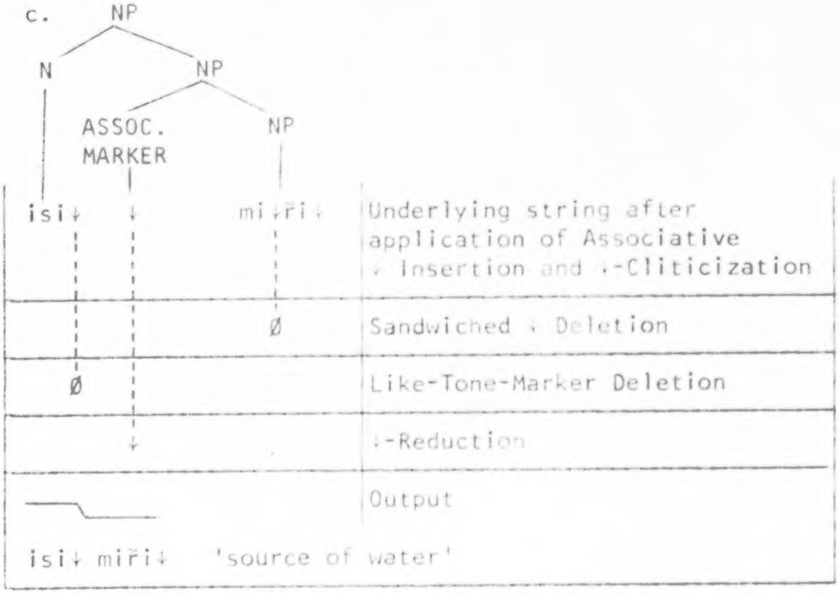
(1-5) a.


NP
N
NP
ASSOC. MARKER
NP
isi↓
↓
eγu↓
Underlying structure after application of Associative ↓ Insertion and ↓-Cliticization
Ø
↓
↓-Metathesis
Ø
Like-Tone-Marker Deletion
↓
↓-Reduction
Output
isi e↓γu↓ 'the head of a goat'

(1-5) b.


NP
N
NP
ASSOC.
MARKER
NP
N
DEM
isi↓
↓
eɣu↓ a↓h̃ụ↑
Underlying string after application of Associative ↓ Insertion and ↓-Cliticization
Ø → ↓
↓-Metathesis
Ø
Internal ↓ Deletion
Ø
Ø
Like-Tone-Marker Deletion
Output
isi eɣu a↓h̃ụ↑
'the head of that goat'

c.


NP
N
NP
ASSOC.
MARKER
NP
isi↓
↓
mi↓ři↓
Underlying string after application of Associative ↓ Insertion and ↓-Cliticization
Ø
Sandwiched ↓ Deletion
Ø
Like-Tone-Marker Deletion
↓
↓-Reduction
Output
isi↓ miři↓
'source of water'

Following the same pattern, the syntactic rules of Pronoun Cliticization and Main Clause ↓ Insertion create the input strings for the phonological rules of Prefix Vowel Replacement and Main Clause Tone Marker Metathesis, respectively.

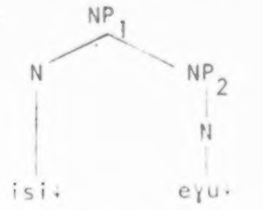
The fact that the syntactic rules of Igbo consistently furnish input strings for the phonological rules while no phonological rule ever creates the input for a syntactic rule is compatible with two different hypotheses about the organization of the grammar. On the one hand, syntactic rules like those of (1-2) and phonological rules like those of (1-3) might both apply as part of the syntactic cycle, with the phonological rules following the syntactic rules within each cycle. This is the rule-ordering which Bresnan (1971) argued for with respect to the Nuclear Stress Rule in English. Alternatively, phonological rules like those of (1-3) might apply at the surface level, after completion of the syntactic component, as was assumed by Chomsky and Halle (1968).

An argument for the latter position can be constructed on the basis of the Principle of Strict Cyclicity, which is repeated below, from Chomsky (1973):

> No rule can apply to a domain dominated by a cyclic node A in such a way as to affect solely a proper subdomain of A dominated by a node B which is also a cyclic node.

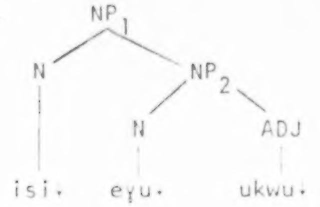
If the Principle of Strict Cyclicity is correct, then labelled-bracket rules like ↓-Metathesis and Internal ↓ Deletion cannot be part of the syntactic cycle. To see that this is so, consider the underlying structures below:

(1-6) a.



'the head of a goat'

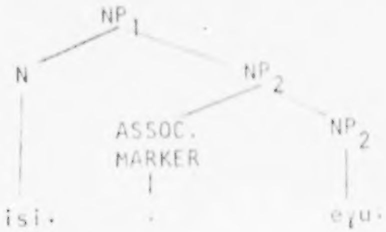
b.



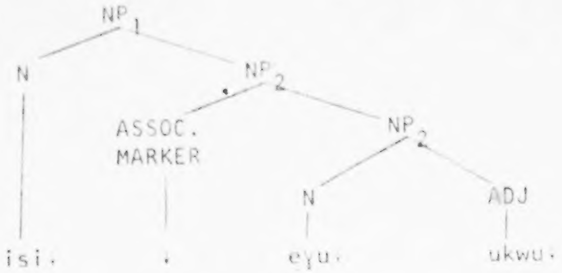
'head' 'goat' 'large' 'the head of a large goat'

The structural description of the rule of Associative ↓ Insertion is not met in these phrases until the NP$_1$ level; consequently it is not until this level that the rule of ↓-Cliticization can adjoin the associative ↓ to NP_2, creating the intermediate structures

(1-7) a.



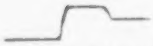
b.



In order to obtain the correct output forms, *isi e↓ɣu↓* and *isi eɣu ukwu↓*, we must now return to NP_2 to apply the rules of ↓- Metathesis (in both (a) and (b)) and Internal ↓ Deletion (in (b) only). But if a NP-node is a cyclic node, as it is usually assumed to be, then the return to NP_2 in these derivations constitutes a violation of the Principle of Strict Cyclicity (1-7). We can preserve the Principle of Strict Cyclicity as a constraint on rules of the syntactic cycle only if labelled-bracketed rules like ↓-Metathesis and Internal ↓ Deletion are not part of the syntactic cycle, but apply at the surface level after the completion of the syntactic component.

Returning to the relative ordering of the four rule-components which we have identified in Igbo, I will now give evidence to show that the phonological rules of (1-3), whose domains are defined in terms of syntactic bracketing, must apply before those of (1-4), whose domains are defined in terms of phonological boundaries.

Consider first the ordering of the bracket-sensitive rule of ↓-Metathesis (1-3e) with respect to the boundary-sensitive rules of ↑-Retraction and Left Streamlining (1-4d,e). Clearly, ↓-Metathesis must apply first, for in examples like the following, in which ↓-Metathesis moves the associative ↓ inside the possessive noun, the ↑ at the end of the head noun is not affected by ↑-Retraction or Left Streamlining:



(1-8) abha↑ e↓ɣu↓ 'the jaw of a goat'

(from *abha↑* + ↓ + *eɣu↓*)

'jaw' 'goat'

To give another example, the bracket-sensitive rule of Internal ↓ Deletion (1-3g) must apply before the boundary-sensitive "streamlining" rules, for if the streamlining rules were to apply first, they would destroy the distinction between the two phrases below:

(1-9) a. e↓go↓ # ↓ # Ekwe↓ ⇒ e↓go↓ Ekwe↓ 'Ekwe's money'

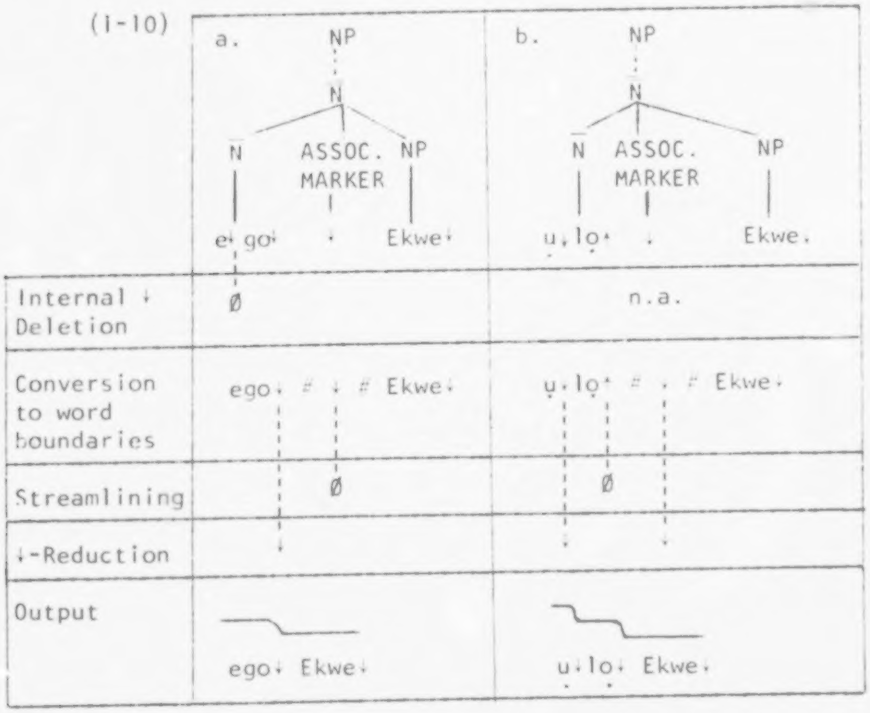
by Streamlining

b. ụ↓lọ↑ # ↓ # Ekwe↓ ⇒ ụ↓lọ↓ Ekwe↓ 'Ekwe's house'

by Streamlining

If Internal ↓ Deletion were to apply at this point, then it could not distinguish between phrases with the underlying structure of (a) and those with the underlying structure of (b). However, it does distinguish between them, for it deletes the internal ↓ of *e↓go↓* in (a), but not that of *ụ↓lọ↑* in (b). Therefore Internal ↓ Deletion must be ordered before the streamlining rules, giving the derivations shown below:

(1-10)


a.
NP
N̄
N̄
ASSOC. MARKER
NP
e↓go↓
↓
Ekwe↓
b.
NP
N̄
N̄
ASSOC. MARKER
NP
ụ↓lọ↑
↓
Ekwe↓
Internal ↓ Deletion
Ø
n.a.
Conversion to word boundaries
ego↓ # ↓ # Ekwe↓
ụ↓lọ↑ # ↓ # Ekwe↓
Streamlining
Ø
Ø
↓-Reduction
Output
ego↓ Ekwe↓
ụ↓lọ↓ Ekwe↓

At the time when Internal ↓ Deletion applies, the final ↑ of *ụ↓lọ↑* is still present in (b), preventing this phrase from meeting the structural description of the rule.

In sum, wherever the ordering of rules can be ascertained, phonological rules whose domains are defined in terms of labelled bracketing are found to apply before those whose domains are defined in terms of phonological boundaries. This analysis thus lends support to the proposal of Selkirk (1976), who argues that there is a point in the derivation of an utterance at which phonological boundaries are introduced and labelled bracketing is erased. Since rules which apply prior to this point can have no information about the nature of phonological boundaries within the utterance, while those which apply afterward have no access to information about labelled bracketing, Selkirk's hypothesis further predicts that there will be no "mixing" of labelled bracketing and phonological boundaries in the structural description of a rule. That prediction is borne out by the analysis of Igbo which has been presented here.[7]

In summary, the tonal system of Igbo provides evidence for the following principles regarding the organization of a grammar:

(1-11) a. Phonological rules apply at the surface level, after completion of the syntactic component.

b. There is a definite point within the phonological component at which phonological boundaries are inserted and labelled bracketing is erased. Rules which apply before this point may not refer to phonological boundaries; rules which apply after this point may not refer to syntactic bracketing.

2. A Constraint on Bracket-Sensitive Rules

I would now like to take a closer look at the two classes of phonological rules for which we have found evidence -- "bracket-sensitive" rules (i.e., rules whose environments are defined in terms of syntactic bracketing) and "boundary-sensitive" rules (i.e., rules whose environments are defined in terms of phonological boundaries.) In this section, I will propose two constraints on bracket-sensitive rules -- one having to do with the nature of the phonological changes which they create, and the other concerning the role of syntactic bracketing in the structural description of a rule. In section 3 below, I will have some observations to make about boundary-sensitive rules. Since the theory of phonological boundaries is just now undergoing fundamental revision (see Selkirk, forthcoming), I will not propose specific constraints on boundary-sensitive rules, but will merely point out some sorts of environments which one would probably want the theory to exclude.

The first point to note with regard to the bracket-sensitive rules of (1-3) is that these are all "prosodic" rules which affect either syllable structure or tone contour. Bracket-sensitive rules of stress and nasality have also been proposed -- for example, the Compound Stress Rule of English is a bracket-sensitive rule. However, I do not know of any SEGMENTAL rules whose domains are defined in terms of bracketing. Furthermore, it would be very surprising, I think, to find a rule which, for example, made a voiced consonant voiceless just in case it was the final segment of a noun phrase. It therefore seems reasonable to propose, as one constraint on bracket-sensitive rules, that the structural changes which they create must involve "prosodic" features such as stress, tone, duration, syllable structure, or nasality.

The second constraint which I would like to propose on the class of bracket-sensitive rules has to do with the way in which syntactic bracketing is used in defining the environment of such a rule. It is striking that in all the rules of (1-3), syntactic bracketing is used only to define the DOMAIN of the rule -- there is never any reference to syntactic bracketing INSIDE the domain of a rule. If, as this analysis suggests, the applicability of a phonological rule never depends on the internal structure of the string inside its domain, then we may limit the role of syntactic bracketing in phonological processes by means of the following constraint:

(2-1) The Structural Analysis Principle

> Syntactic bracketing may not appear in the structural description of a phonological rule except to define the domain of the rule.

This constraint excludes phonological rules like the following hypothetical one, which inserts a ↓ after the first syllable of a non-verbal phrase which is preceded by a nominal phrase:

(2-2) $[\ldots[\ldots]_{[+N]}\ {}_{[-V]}[\sigma\ldots]\ldots]$[8]

s.d. 1 2 3 4 5

s.c. Insert a ↓ after 3.

Something like the Structural Analysis Principle is generally assumed, I believe, for phonological rules other than tone rules, for I am not aware of any proposed rules like the one shown below, which parallels the hypothetical rule (2-2) except that the change it creates is a change in stress of nasality rather than in tone:

(2-3) $[\ldots[\ldots]_{[+N]}\ [-V]^{[\sigma\ldots]\ldots]}$

s.d. 1 2 3 4 5

s.c. Assign stress to 3.

or

s.c.' Make 3 [+nasal]

In contrast, one frequently encounters TONE rules which are stated in such a way as to violate the Structural Analysis Principle (and the principle of (1-13b) as well). For example, the following four tone rules which are proposed by Goldsmith (1976) all violate the Structural Analysis Principle:

(2-4) a. $[+\text{tone}] \rightarrow [-\text{high}]\ /\ [[-\text{low}]]_{Af}\ \#\#\ ([+\text{tone}])\_\_\_\#\#$[9]

b. $[+\text{low}] \rightarrow \emptyset\ /\ [[-\text{low}]]_{Af}\ \#\#\ \_\_\_$

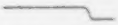
c. $[+\text{tone}] \rightarrow \begin{bmatrix}-\text{high}\\+\text{low}\end{bmatrix}\ /\ \_\_\_\ X\ {}_S[[+\text{low}]$

Condition: X contains no # and no [+low]

d. V [CV
VP
T

Rule (a) above accounts for the lowering of the second syllable of *eɣu* 'goat' in the phrase
H H

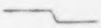
(2-5)



isi eɣu 'the head of a goat'

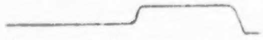
Rule (b) accounts for the loss of the initial low tone of *oke*
L H
'rat' in the phrase

(2-6)



isi oke 'the head of a rat'

Rule (c) accounts for the lowering of a string of high-toned syllables at the end of a NP in topic position when the following clause begins with a low tone, as in the question

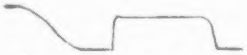


(2-7) Ekwe ọ dị na ebe a? 'Is Ekwe here?'
L L L L H H H L

(Ekwe)
H H

Rule (d) accounts for the falling glide at the end of the subject of a main clause completive verb, as in the statement

(2-8)



Ekwe dị na ebe a. 'Ekwe is here.'
H HL L H H H L

I am not certain whether or not it is POSSIBLE to state rules for these four tonal phenomena in level-tone terms without violating the Structural Analysis Principle; however, as we have seen, it is certainly possible to do so within a dynamic-tone theory. For example, in the dynamic-tone analysis which has been proposed here, the lowering of the second syllable of *eɣu↓* in (2-5) is accounted for by means of the rules of ↓-Cliticization (1-2e) and ↓-Metathesis (1-3e), the first of which is a syntactic rule, and the second of which is a phonological rule in which labelled bracketing serves only to indicate that the domain of the rule is a nominal phrase. The "smoothing out" of the tone contour of *o↑ke↓* in (2-6) is accounted for by means of the rule of Right Streamlining (1-4c), which deletes the ↑ of *o↑ke↓* in the environment of the associative ↓. This rule, being a boundary-sensitive rule, makes no use of labelled bracketing. The lowering of *Ekwe↓* in (2-7) is accounted for by another boundary-sensitive rule -- the rule of Phrase-final ↓ Deletion (1-4j). Finally, the falling glide at the end of *Ekwe↓* in (2-8) is the indirect result of the main clause ↓, which causes the lengthening of the final syllable of *Ekwe↓* so that the ↓ at the end of *Ekwe↓* is absorbed into that syllable as a falling glide. It is a potential advantage of the Dynamic Tone Theory that it allows us to account for all these phenomena without violating the Structural Analysis Principle.

In prohibiting the use of labelled bracketing inside the domain of a phonological rule, the Structural Analysis Principle prohibits the statement of rules which alter the phonological composition of a constituent in response to features of the larger syntactic environment in which that constituent appears. This prohibition, which presumably arises from the perceptual difficulty of analyzing a string in both syntactic and phonological terms at the same time,[10] severely restricts the way in which the larger syntactic environment may affect the applicability of a phonological rule is never affected by the syntactic position of the constituent to which it applies. For example, the Igbo rule of ↑-Deletion (1-1e) applies only to verbs which occupy a particular syntactic position. This rule is repeated below:

(2-9)
$$\underset{\begin{bmatrix}\text{+SUB CL}\\ \text{-SUBJ}\end{bmatrix}}{{}_{V}[\ldots\uparrow\ldots]}$$

s.d. 1 2 3

s.c. Delete 2.

The feature [+SUB CL] in this rule indicates that the verb to which the rule applies must be the main verb of a subordinate clause (i.e. a clause one of whose arguments is a bound variable). The feature [-SUBJ] indicates that the verb has no overt subject (i.e., the bound variable occupies subject position). Notice that it is only by encoding the larger syntactic environment in these features that we have been able to state rule (2-9) without violating the Structural Analysis Principle. Without these features, we would have been forced to state the rule in the following form:

(2-10)
$$\underset{[\text{+SUB CL}]}{{}_{S}[}\,{}_{V}[\ldots\uparrow\ldots]_{V}\ldots\underset{[\text{+SUB CL}]}{]_{S}}$$

s.d. 1 2 3 4

s.c. Delete 2.

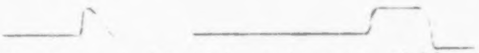
The strategy which we have used to avoid violating the Structural Analysis Principle in stating the rule of ↑-Deletion is justified only to the extent that the features [±SUB CL] and [±SUBJ] can be independently motivated as features on verbs. Such motivation is available from considerations of inflectional morphology. Thus verb features like [±SUB CL], which indicate the type of clause in which the verb may appear, are independently motivated by the many languages (Igbo among them) which mark the verb of a relative clause with a distinctive affix. Similarly, verb features like [±SUBJ], which indicate what kind of subject a verb may have, are independently motivated by the many languages in which the choice of inflectional affixes in the verb depends on the person and number of the subject. Moreover, the particular features [±SUB CL] and [±SUBJ] which appear in the structural description of rule (2-9) are independently motivated by the inflectional morphology of Igbo, for the former feature is needed to account for the distribution of the subordinate clause prefix "↓", and the latter to account for that of the "object-changing" suffix "↓". If the Structural Analysis Principle is correct, then the applicability of labelled-bracket sensitive rules to particular constituents should be affected by the larger syntactic environment only in cases like this, in which there is independent motivation for features marking that constituent for that syntactic environment.

3. Phonological Boundaries

In the phonological rules which have been proposed in this work, I have made use of five distinct boundary-symbols: the "major" phrase-boundary, "$$", the "minor" phrase-boundary, "$", the "strong" word-boundary, "##", the "weak" word-boundary, "#", and the morpheme-boundary, "+". I assume that all occurrences of the morpheme boundary + derive from lexical representations, but that the boundary symbols, $$, $, ## and most occurrences of # are inserted by rules which have access to syntactic structure as defined by labelled bracketing, and probably also to certain kinds of information about the semantic structure of the sentence.

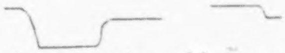
A "major" phrase-boundary, $$, is found at the beginning and end of a sentence, and, under certain circumstances, at the beginning of a clause within a sentence, as in the examples

(3-1) a.



As for me $$ I'd rather go skiing.

b.



Ọ gara ahya $$ h̄u m. 'He went to the market and saw me.'

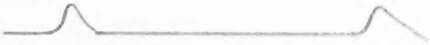
(from *ọ* + *gara*↑ + *ahya*↓ + *h̄ụ* + ↓ + *m*↓)

'he' 'went' 'market' 'saw' 'me'

A major phrase boundary is marked by a pause and a re-setting of the pitch level of the voice. In English and in Igbo major phrase boundaries seem to occur only at the left boundaries of root clauses, and at the ends of sentences.

A minor phrase-boundary differs from a major phrase-boundary in its distribution and in the fact that it does not involve a re-setting of the pitch register of the voice. In English, where each minor phrase has its own intonation contour, it is common to find a minor phrase-boundary between the subject and the predicate of a sentence, as in

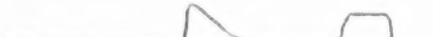
(3-2)



Jim Rice $ just hit a home run.

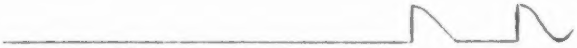
However, if a minor phrase is defined as a section of the string which has its own intonation contour, then a minor phrase boundary can be found almost anywhere in English, for example

(3-3) a. *Between the subject and predicate of a subordinate clause:*



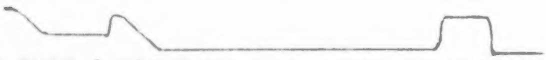
$$ I don't think BILL $ can DO it. $$

b. *Between an adjective and the noun it modifies:*



Don't tell me you've bought a PINK $ TIE. $$

c. *Between a demonstrative and the noun it modifies:*

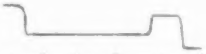


$$ THAT $ MAN $ happens to be my HUSBAND.$$

Notice that each minor phrase in the examples above contains a focal element of the sentence; the phrase-boundary is placed at the end of the largest syntactic phrase which contains only one such element. Thus, although syntactic structure has some influence on the position of a particular phrase-boundary, the criteria by which minor phrase-boundaries are inserted into the string are primarily semantic.

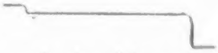
While in intonational languages like English it seems to make sense to identify a minor phrase as a section of a string which has its own intonation contour, it is less clear what constitutes a minor phrase in a non-intonational language like Japanese or Igbo. Data given by Haraguchi (1975) suggests that a minor phrase in Japanese is marked by the presence of a rise in pitch after the first syllable of the phrase. Thus, for example, the string

(3-4)



umi-de $ oyogi

or

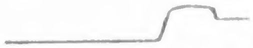


umi-de ## oyogi

'swimming in the sea'

has the two possible tone shapes shown above, depending on whether it is treated as one phrase or two. I have suggested that in Igbo a minor phrase-boundary is marked by the deletion of a phrase-final ↓ with the result that a string of high-toned syllables at the end of a minor phrase has the same pitch level as the phrase which follows it. Examples are given below:

(3-5) a.

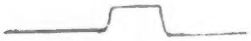


Ekwe $ ọ dị↑ m↓ma↓? 'is Ekwe all right?'

(from *Ekwe↓* + *ọ* + *↑dị↑* + *m↓ma↓*)

'he' 'is' 'good'
(completive
question
form)

b.



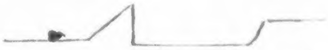
eɣu $ A↑dha↓ h̃ụr̃ụ↑ 'the goat Adha saw'

(from *eɣu↓* + *A↑dha↓* + *↓h̃ụr̃ụ↑*)

'goat' 'saw'
(completive sub. cl. form)

By this criterion, it would appear that minor phrase-boundaries do not occur so frequently or so freely in Igbo as they do in English (or Japanese?). However, note that a phrase-boundary between the subject and the predicate of a clause in Igbo would have very little effect on the tone shape of the clause, because there is a [↓] between the subject and the predicate of most clauses, and the presence of that [↓] would mask the deletion of the final ↓ of the subject. Thus in these cases, the only effect of a $ between the subject and the predicate would be to block the application of sandhi rules in the direction of the phrase boundary. This may be why the rules of ↑-Retraction and Left Streamlining sometimes do not apply as expected in the environment of a subordinate-clause ↓, as in the example below from Green and Igwe (1963):

(3-6)



abọ Ugho↑ ↓ewela↑ eci↓ 'the baskets which Ugho should
have taken back yesterday'
(from *abọ↓* + *Ugho↑* + *↓ewela↑* + *eci↓*)
'baskets' 'should have 'yesterday'
taken back'
(aff. incompletive sub. cl. form)

The fact that the ↑ of *Ugho↑* is not deleted in the environment of the ↓ at the beginning of *↓ewela↑* in this example could be accounted for by postulating a minor phrase boundary after *Ugho↑*.

Finally, let us consider the distribution of the strong and weak word boundaries, "##" and "#". In contrast to the minor phrase boundary ($), whose distribution depends primarily on the position of focal elements with the sentence, the word-boundaries "##" and "#" are generally assumed to be inserted by rules which refer to syntactic structure alone; consequently, these boundaries encode a certain amount of information about the syntactic structure of the string in a form which is visible to phonological rules. Now recall that we have introduced a constraint -- the Structural Analysis Principle -- which controls the amount and kind of syntactic information which can figure in a labelled-bracket-sensitive phonological rule. If we wish to restrict the role which syntactic structure may play in phonological processes in general, then it will be necessary also to limit the information about syntactic structure which is made available to phonological rules in the form of word-boundaries.

Chomsky and Halle (1968) proposed the following general boundary-insertion conventions to account for most occurrences of the symbol "#" within a phonological string:

(3-7) SPE-I

The boundary # is automatically inserted at the beginning and end of every string dominated by a major category, i.e., by one of the lexical categories "noun", "verb", "adjective", or by a category such as "sentence", "noun phrase", "verb phrase", which dominates a lexical category.

SPE-II

In a sequence $W\#]_x \; \#]_y$ or ${}_y[\# \; {}_x[\#W$, where $y \neq S$,[11] delete the inner word boundary.

The effect of the conventions of (3-7) is to insert two #'s between every two "lexical" words of the phrase. For example, given the sentence

(3-8) $${}_S[{}_{NP_1}[\text{Children}]_{NP_1} \; {}_{VP}[{}_V[\text{like}]_V \; {}_{NP_2}[\text{hamburgers}]_{NP_2}]_{VP}]_S$$

SPE-I inserts #'s at the beginning and end of NP_1, V, NP_2, VP, and S to produce

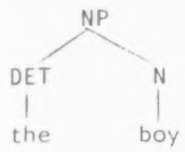
(3-9) $${}_S[\#{}_{NP_1}[\#\text{Children}\#]_{NP_1} \; {}_{VP}[\#{}_V[\#\text{like}\#]_V \; {}_{NP_2}[\#\text{hamburgers}\#]_{NP_2}$$
$$\#]_{VP}\#]_S$$

and *SPE-II* then reduces the number of #'s at the beginning and end of VP, creating the following distribution of boundaries:

(3-10) ## Children ## like ## hamburgers ##

In a phrase like that of (3-10), in which all the words belong to the "lexical" categories "noun", "verb", "adjective", and "adverb", the effect of the *SPE* word-boundary conventions is simply to place a "##" between every two successive words; in other words, word boundaries serve only to indicate where the words begin and end. However, because the boundary-insertion rule *SPE-I* places #'s only at the boundaries of phrasal or lexical categories, and not at the boundaries of grammatical categories like "preposition", "auxiliary", "determiner" and so forth, word-intersections like the one below are marked only with a single word boundary:

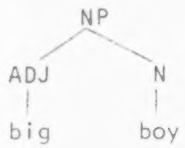
(3-11)



⟹ # the # boy #

The phrase above contrasts in this respect with the phrase

(3-12)



⟹ # big ## boy #

The *SPE* word-boundary conventions thus prescribe a single word boundary at the intersection between a grammatical category and a lexical or phrasal category which is sister to it. This "single" word boundary contrasts with the double word boundary which is found at all other word-intersections.[12]

There are many phonological processes which honor the distinction between a single ("weak") and a double ("strong") word boundary.[13] For example, the rule of Nasal Assimilation, which gives a nasal consonant the same point of articulation as the consonant which follows it, applies not only within a lexical word, but also between a preposition and its object, so that the phrase "in Boston" may be pronounced

(3-13) [I m̲ bɔstən]

In contrast, Nasal Assimilation never applies at the boundary between an adjective and the noun which it modifies; the phrase "urban Boston" could not be pronounced:

(3-14) *[ṛbəm bɔstən]

The *SPE* word-boundary conventions provide a way of accounting for this difference, for they assign the phrase of (3-13) the representation

(3-15) # in # Boston #

while the phrase of (3-14) is given the representation

(3-16) # urban ## Boston #

If the rule of Nasal Assimilation is then stated as follows:

(3-17) $[+\text{nas}] \rightarrow [\alpha\text{place}] \;/\; \_\_\_ \;(\#) \begin{bmatrix}+\text{consonant}\\ \alpha\text{place}\end{bmatrix}$

then it will apply, correctly, in (3-15) but not in (3-16).

Another rule of English which honors the distinction between a double and a single word boundary is the rule of Consonant De-voicing, by which all the consonants in a consonant cluster which contains a voiceless consonant become voiceless. Besides applying within a single word (as in the word *waltz* (=[wɔl̥ts])), this rule may also apply at the boundary between a preposition and its object, as in the phrase

(3-18) (the) mass of Canada [mæs ## əf # kænədə]

(from [mæs ## əv # kænədə])

However, it cannot apply at the boundary between an adjective and a noun, as in the phrase

(3-19) massive Canada [mæsIv ## kænədə]

(*[mæsIf ## kænədə])

Again this difference can be accounted for by the distinction which the boundary-placement conventions make between single and double word-boundary contexts.

If boundary-sensitive rules have access to just that information about syntactic structure which is preserved in the form of phonological boundaries, then a theory in which the distribution of word boundaries was entirely determined by the SPE word-boundary conventions would place very tight restrictions on the role of syntactic structure in phonological processes.[14] That is because (1) the theory provides only two distinct boundary symbols, ## and #, and (2) the nature of the syntactic distinction which is made by choosing one boundary symbol rather than the other is very rigidly prescribed.

Unfortunately, it is not possible to maintain so restrictive a theory of word boundaries, for there are phonological processes whose syntactic distribution does not accord exactly with the distinction between single and double word-boundary contexts which is obtained by following the SPE conventions. This fact has been most clearly demonstrated by Lisa Selkirk (1972, 1974).

Selkirk's argument is based on the assumption that *liaison* contexts in French are to be identified with the presence of a weak (= single) word boundary. Selkirk gives two sorts of evidence for this hypothesis. First is the fact that in familiar conversational French, the distribution of *liaison* contexts corresponds very closely to the distribution of single word boundaries which is predicted by the SPE conventions. Thus, according to Selkirk, the *liaison* contexts of familiar conversation are for the most part comprised of a non-lexical item (e.g. a preposition, article, pronominal clitic, etc.) and what follows it. Examples are given below (it is the failure of the underlined word-final consonants to delete before a vowel which marks these as *liaison* contexts):

(3-20) a. des ennuis 'troubles'

b. dans une salle 'in a room'

c. Paul nous appelle 'Paul is calling us'

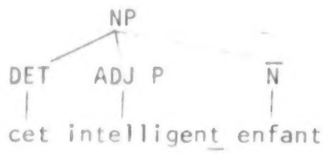
A second argument which Selkirk gives for identifying *liaison* contexts with weak word boundaries is the fact that these contexts function as environments for, or as exceptions to, several independent phonological processes, including the deletion of a word-final consonant, nasalization, changes in vowel quality, and so on. Since it could hardly be accidental that the same set of syntactic environments should figure in several distinct phonological rules, these environments must have some distinguishing property which is visible to phonological rules. It is difficult to imagine what that property might be if not the presence of a weak word-boundary.

The need for language-specific boundary-assignment rules is demonstrated by the fact that although the *liaison* contexts of French correspond very closely to the weak word-boundary contexts which are defined by SPE I and II, the correspondence is not exact. For example, in familiar conversational French, not EVERY member of a non-lexical category forms a *liaison* context with its sister-constituent -- only monosyllabic non-lexical items do. Consequently, if we wish to identify *liaison* contexts with weak word boundaries, then we must add a special rule to introduce word-boundaries around non-lexical items with more than one syllable. Selkirk states this rule in the following way:

(3-21) $C_0VC_0VC_0X \Rightarrow \#C_0VC_0VC_0X\#$

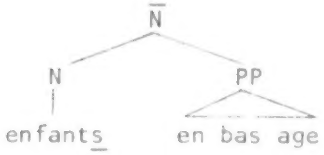
There are also mis-matches in the other direction, for even lexical or phrasal categories form *liaison* contexts with sister constituents in certain syntactic environments. For example, an adjective forms a *liaison* context with the noun which it modifies, and, in a certain elevated style of French, the boundary between an inflected noun, verb, or adjective and its complement also functions as a *liaison* context. Examples are given below (again, it is the fact that the underlined consonants are not deleted which identifies these as *liaison* contexts):

(3-22) a.



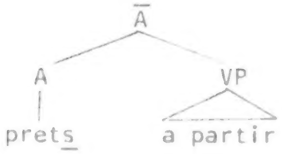
'this intelligent child'

b.



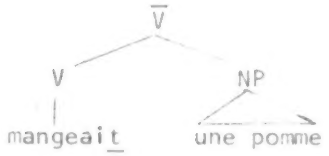
'children of a young age'

c.



'ready to leave'

d.



'was eating an apple'

By the SPE word-boundary conventions, the underlined consonants of the examples above should each be followed by a double word boundary, since each of them comes at the end of a lexical or phrasal category which is followed by a phrasal category. Thus, if we wish to identify *liaison* contexts with single word boundaries, then we must add rules which convert a strong (double) word boundary to a weak (single) one in these contexts. Selkirk states these rules as boundary-deletion rules, of the form shown below:

(3-23) a. The Adjective-Noun Rule

$${}_{\bar{\bar{N}}}[\#\text{X}\ {}_{\bar{\bar{A}}}[\#\text{Y}\ {}_{\bar{A}}[\#\text{Adjective}]_{\bar{A}}\ \#]_{\bar{\bar{A}}}\ {}_{\bar{N}}[\#\text{Noun}\ \#\ \text{Z}]_{\bar{N}}\ \#]_{\bar{\bar{N}}}$$

$${}_{\bar{\bar{N}}}[\#\text{X}\ {}_{\bar{\bar{A}}}[\#\text{Y}\ {}_{\bar{A}}[\#\text{Adjective}]_{\bar{A}}\ ]_{\bar{\bar{A}}}\ {}_{\bar{N}}[\#\text{Noun}\ \#\ \text{Z}]_{\bar{N}}\ \#]_{\bar{\bar{N}}}$$

b. The X-Comp Rule

$${}_{\bar{\bar{X}}}[\#\text{Y}\ {}_{\bar{X}}[\#\ [{}_{X}[+\text{inflected}\#]_{X}\ \text{Z}]_{\bar{X}}\ \#]_{\bar{\bar{X}}}$$

$${}_{\bar{\bar{X}}}[\#\text{Y}\ {}_{\bar{X}}[\#\ [{}_{X}[+\text{inflected}]_{X}]\ \text{Z}]_{\bar{X}}\ \#]_{\bar{\bar{X}}}$$

Rule (a) above deletes the righthand # of a prenominal adjective phrase, and rule (b) deletes the righthand # of a lexical category (noun, verb, or adjective) which is followed by a complement ("Z" in the rule).[15]

That the boundary-assignment rules of (3-21) and (3-23) are language-specific rules rather than universal conventions, is shown by the fact that rules (3-21) and (3-23b) do not even occur in all varieties of French -- rule (3-21) is particular to familiar conversational French, and rule (3.23b) to a certain "elevated" style. Rule (3-23a), while common to all varieties of French, does not apply to English, as can be seen from example (3-14) and (3-19) above. Clearly, languages vary somewhat in what syntactic environments they choose to mark with a weak word boundary as opposed to a strong one; it is not possible to account for the distribution of boundaries by universal conventions alone.

While it is clear that language-specific rules must be allowed in the component of the grammar which converts syntactic bracketing to phonological boundaries, it is important to place strong constraints on these rules, for if a language could designate any arbitrarily-chosen syntactic environment as its only single-word-boundary context, then it would be possible for a phonological rule to have any syntactic distribution at all. But surely that is not the case; for example, we noted in the preceding section that one would not expect to find a phonological rule which applied to a word just in case that word was followed by a NP.

The Structural Analysis Principle prevents the statement of such a rule as a bracket-sensitive rule, but we will also want to be sure that such a rule cannot be stated as a boundary-sensitive rule. In order to do this, we must constrain the boundary-assignment component of the grammar, for if a language were to make the lefthand boundary of a NP its only single-word-boundary context, then a rule of the form

(3-24) $[+\text{nas}]\ (\#)\ \begin{bmatrix}+\text{cons}\\ \alpha\text{place}\end{bmatrix}$

s.d. 1 2 3

s.c. Make 1 $[\alpha\text{place}]$

would, in fact, apply only inside a word and at the lefthand boudary of a NP.

There are several plausible ways of preventing a syntactic environment like "the boundary between a NP and the constituent which precedes it" from being singled out by the boundary-assignment conventions. In the first place, it is important to limit the number of distinct syntactic boundaries, maintaining, if possible, the SPE assumption that there are only two distinct boundaries (the weak and strong word boundaries) whose distribution is determined by syntactic criteria alone. In addition, it is important to discover principles which govern the distribution of strong and weak word boundaries in languages which make this distinction. It is easy to think of such principles. For example, in all the cases I know of, the constituents to either side of a "weak" word boundary are sisters to one another, and at least one of them is a member of a "lower" level syntactic category (i.e., not a NP, AP, VP, or S). Weak word boundaries are found between a lexical category and its complement, or between two elements of a simple NP, but not between the subject and the predicate of a clause or the direct and the indirect object of a verb. Thus it seems plausible to suggest that rules which weaken "strong" word boundaries must be of the form

(3-25) $[\ \ldots\ \alpha\#\#\beta\ \ldots\ ]_{\gamma}$

s.d. 1 2 34 5

s.c. Make 3 a weak boundary.

where α and β are syntactic constituents immediately dominated by γ, and where either α or β or both is a member of a non-phrasal category. Given a restriction of this sort on the form of boundary -

weakening rules, it would not be possible for a language to mark the lefthand boundary of a NP as a weak boundary without regard to the nature of the constituent preceding the NP of the relationship it bears to the NP.

Just as there are some syntactic environments which could probably never serve as weak word-boundary contexts, there are others which almost invariably do. In particular, the boundary between a monosyllabic "grammatical" word and its sister constituent is almost always a weak word boundary, and the theory of boundaries should reflect this fact. One way to do this is to introduce universal boundary-assignment conventions (like the SPE-conventions) which establish a weak word boundary at the intersection between any grammatical word and its sister constituent. Then it will be necessary to introduce a special rule (at some cost) to create a strong word boundary in any context of this type. Alternatively, the weak word boundaries which typically appear at the boundaries of grammatical words might be made to result automatically from cliticization processes, for it is striking that the same sorts of words are involved in both phenomena.[16]

In addition to constraining the boundary-assignment component of the grammar, we will also want to restrict the role which boundaries can play in phonological processes themselves. In a very attractive proposal first advanced by McCawley (1965), boundaries are regarded not as units in the string, but as a special sort of bracketing. In this view, a bracket-sensitive rule is said to apply to a domain delimited by boundaries of a certain type; for example, a given rule might apply to a string of the form ## ... ##, or to a string of the form \$ ... \$. This theory of boundaries requires the notion of a hierarchy of boundary-strength, which would arrange our five boundary symbols in the order \$\$, \$, ##, #, +, going from strongest to weakest. In this view, a rule which is defined on a domain delineated by the boundary B_i applies to a string of the form $B_i \ldots B_i$, where "..." contains no boundary B_j which is equal to or higher than B_i in the boundary-strength hierarchy. It would be a simple matter to re-state the boundary-sensitive rules of Igbo within a theory of this sort.

This treatment of phonological boundaries as a sort of bracketing which defines the domain of phonological processes suggests the possibility of a constraint on boundary-sensitive rules paralleling the Structural Analysis Principle, forbidding any reference to boundary symbols inside the domain of a phonological rule. Such a constraint would have the desirable effect of preventing the expression of improbable environments like "in the position following a monosyllabic word." Unfortunately, some of the boundary-sensitive rules which have been proposed here for Igbo make crucial reference to boundaries inside the domain of a rule, and so violate the proposed constraint. These are the rules of ↑-Retraction and Left Streamlining (1-4d,e) and the rule of Like-Tone-Marker Deletion (1-4i). It would be possible to re-state the rules of ↑-Retraction and Left Streamlining in such a way as to avoid mention of the internal boundaries which violate the constraint, by stating the conditions on these rules as conditions on the DOMAIN of the rule rather than as conditions on the nature of internal boundaries. For example, the rule of ↑-Retraction could be stated as follows:

(3-26) ${}_{B_i}[\ldots\sigma\ \sigma\ \uparrow\ \downarrow\ \ldots]_{B_i}$

s.d. 1 2 3 4 5 6

s.c. Transpose 3 and 4.

Conditions: a. $B_i \leq \$$.

b. If 3 is long, then $B_i \leq \#\#$.

Condition (a) above states that the rule applies within a domain delineated by boundaries of strength less than or equal to that of the boundary "$". Condition (b) states that if 3 is long, then the rule applies only inside a domain delineated by boundaries of strength less than or equal to that of the boundary "##"; that is, in this case the rule applies only within the domain "#...#" or "##...##".

The rule of Like-Tone-Marker Deletion constitutes a more serious counterexample to the proposed constraint. The expansion of this rule which deletes a ↓ before a ↓ is stated as follows:

(3-27) ↓ ## ... ↓ ... $$

s.d. 1 2 3 4 5 6

s.c. Delete 1.

The presence of term 2 in the structural description of this rule is necessary to insure that the rule deletes only word-final ↓'s; it should not delete a word-internal ↓ (as in the word *e↓go↓* 'money'), nor should it delete a word-initial ↓, (as in the word *↓aỹị↓* 'us'). I do not at present see any way of eliminating the internal "##" from the statement of this rule. A similar problem exists with respect to the Kikuyu rule of Like-Tone-Marker Deletion

(Chapter II (4.4-14)) and the rule of ↑-Shift in Osaka Japanese (Chapter II (2-15)). Unless some other way of stating these rules can be found, it will not be possible to forbid the mention of phonological boundaries inside the domain of a boundary-sensitive phonological rule.

FOOTNOTES TO CHAPTER VIII

[1] There are no crucial ordering relationships among the rules of this section; the correct output will be obtained in every case if the rules are allowed to apply whenever their structural descriptions are met, with a string which meets the structural description of two or more rules undergoing all of them at once.

[2] By a "syntactic" rule, I mean one which inserts, moves, or deletes a syntactic constituent.

[3] There are no crucial ordering relationships among the rules of this section; the correct output will be obtained in every case if the rules are allowed to apply whenever their structural descriptions are met.

[4] Crucial ordering relationships among the rules of this section are shown below:

(i) Prefix Vowel Replacement
Main Clause Tone Marker Metathesis
Associative ↓ Deletion
↓-Metathesis
Sandwiched ↓ Deletion
Internal ↓ Deletion

The ordering of Associative ↓ Deletion before ↓-Metathesis and of Sandwiched ↓ Deletion before Internal ↓ Deletion is made necessary by the fact that a string which meets the structural description of both rules of either pair undergoes only the first of them. It is difficult to see how rule relationships of this sort could be accounted for in a theory like that proposed by Koutsoudas, Sanders, and Noll (1971), which does not permit extrinsic ordering among rules.

Except for these three cases, the correct output will be obtained in every case if the rules of this component are allowed to apply whenever their structural description is met.

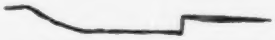
[5] Crucial ordering relationships among the rules of this component are shown below:

(ii) Syllable Lengthening
Syllable Shortening
Right Streamlining
↑-Retraction
Left Streamlining
Syllabic-Nasal Raising
↓-Metathesis
Phrase-final ↓ Deletion
Like-Tone-Marker Deletion
↓-Reduction

The ordering of Syllable Lengthening before Syllable Shortening expresses the fact that a string which meets the structural description of both rules is SHORT in its output form; in other words, Syllable Shortening reverses the effect of Syllable Lengthening in the forms to which it applies.

The ordering of the syllable-duration rules before the rules of ↑-Retraction and Left Streamlining is necessary because the applicability of the latter two rules depends on the duration of of the syllable preceding the target tone marker.

The rule of Right Streamlining must be ordered before Left Streamlining so as to account for the fact that the main clause ↓ causes the deletion of the completive prefix ↑ in a clause like

(iii) 

Ekwe↓ lara↑ ahya↓. 'Ekwe left the market.'

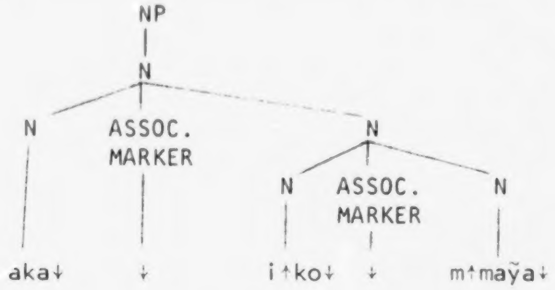
(from *Ekwe↓ # ↓ # ↑lara↑ ## ahya↓*

If Left Streamlining were ordered first, then the completive ↑ would cause the deletion of the main clause ↓ rather than the other way around.

In all other cases, the correct output will be obtained if the rules are allowed to apply whenever their structural description is met, with a string which meets the structural description of two or more rules undergoing all of them at once.

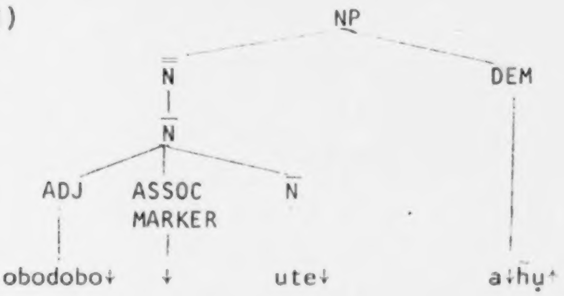
[6] I assume here that the rule of Associative ↓ Insertion is a cyclic rule. If this assumption is correct, then every node must be a cyclic node, as was proposed by Williams (1974), for the rule of Associative ↓ Insertion applies to any level nominal phrase. For example, it applies at the N-level in the phrase *aka↓ iko m↓may̆a↓* 'wine-cup handle', which has the underlying structure

(v)



and at the $\overline{N}$-level in the phrase *obodobo u↓te a↓hụ̃⁺* 'that wide mat', which has the underlying structure

(vi)



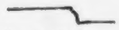
[7] While, as I have pointed out here, there seems to be no need for boundary-sensitive phonological rules ever to refer to syntactic bracketing, they must have access to features which designate particular morphemes or morpheme classes. For example, the rule of English which converts the article [ən] to [ə] before a consonant should apply only to this morpheme, and not, for example, to the preposition *in*, which may have the same pronunciation. Thus the rule must be stated

(iv)	n [+an]	#	[+cons]
s.d.	1	2	3
s.c.	Delete 1.		

where the feature [+an] indicates that the [n] which is deleted must belong to the morpheme *a/an*.

[8] Recall that there are phrases in Igbo which look as if they had undergone a rule very much like (2-2), for example

(vii)

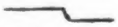


isi e↓γụ↓ 'the head of a goat'

(from *isi*↓ + ↓ + *eγụ*↓)

The Structural Analysis Principle forces us to use a sequence of two rules to account for the surface position of the associative ↓ in this phrase: one (the rule of ↓-Cliticization) adjoins the associative ↓ to the possessive NP, and the other (the rule of ↓-Metathesis) transposes a ↓ at the beginning of a NP with a following high-toned syllabic segment. But notice that each of these rules is independently motivated. For example, without the rule of ↓-Cliticization, it would be difficult to state the rule of Sandwiched ↓ Deletion, which applies in the derivation of (I-7c), and difficult to account for the difference in the realization of the associative ↓ in the common and proper noun possessives below:

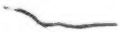
(viii) a.



isi ↓ji↓ 'the top of a yam'

(Associative ↓ realized as a sharp drop in pitch between the two words of the phrase)

b.



isi ↓Chi↓ 'Chi's head'

(Associative ↓ realized as a falling glide on the final syllable of *isi*↓)

Similarly, the rule of ↓-Metathesis accounts not only for the position of the associative ↓ in (vii), but also for the fact that there are no nouns with initial ↓'s, though there are verbs of this form. The value of the Structural Analysis Principle is that it forces us into the two-rule analysis which we would eventually have to adopt in any case.

[9] Except for spelling out tone segments in terms of features, I have repeated these rules exactly as they are stated by Goldsmith. Although certain observational inadequacies in these rules have been pointed out in the course of this work, these do not derive from the use of syntactic bracketing; in fact, in some cases it will be necessary to add additional syntactic bracketing in order to make the rules do what they are supposed to do. The single exception to this statement is rule (d). If we assume that there is a phrase boundary at the lefthand edge of a root clause, then this rule can be re-written as

(ix) [+tone] → [+low] / ___ X \$ [+low]

where X contains no # and no [+low]

This re-writing of the rule eliminates the internal bracketing to which we are objecting here. However, notice that we have not made the rule a more plausible one, for it would be very odd to find an assimilation rule which applied only over a phrase boundary, and not over the weaker boundaries ## and #.

[10] One might wish to propose a similar constraint on syntactic rules, to the effect that no reference could be made to the phonological structure of the string within the domain of such a rule. However, notice that two of the syntactic rules of (1-2) -- the rule of Pronoun Cliticization and the rule of Main Clause Insertion -- refer to phonological structure. This reference may not be absolutely necessary in the case of the rule of Main Clause ↓ Insertion, for if boundary-sensitive rules are permitted to refer to morpheme-identification features (as appears to be necessary -- see fn. 8 above), then the rule of Main Clause ↓ Insertion could be stated in the more general form

$$(x) \quad [\text{NP} \quad \underset{\begin{bmatrix}-\text{SUB CL}\\ +\text{IND}\\ -\text{Q}\end{bmatrix}}{\text{VP}}]_{S}$$

s.d. 1 2

s.c. Insert the morpheme [↓] between 1 and 2.

The fact that there is no main clause ↓ when the subject ends with a ↑ could then be accounted for by means of a boundary-sensitive rule of the form

(xi) ↑ # ↓

s.d. 1 2 3, where 3 is the "main clause" ↓.

s.c. Delete 3.

However there seems to be no way to avoid referring to phonological structure in the syntactic rule of Pronoun Cliticization (1-2a), for there is no other feature which distinguishes the cliticizing pronouns of Igbo from the non-cliticizing pronouns, except the fact that they contain only one phonological segment. Apparently, some types of syntactic rules must be allowed to refer to phonological structure.

[11] SPE-II is never actually stated in *SPE*, though it is assumed throughout. The statement of the rule which I give here is taken from Selkirk (1972).

[12] There is also a third possible case -- the boundary between two grammatical items which are sisters to one another. Here the *SPE* conventions insert no word boundary at all. An example of such a context would be the boundary between two auxiliary verbs, or between an auxiliary and the negative particle *not*.

[13] The examples given here of phonological rules which honor the distinction between single and double word boundaries are taken from Selkirk (1972).

[14] As far as I know, no one has ever proposed such a theory; Chomsky and Halle (1968) note that language-specific boundary-insertion and boundary-deletion rules will be needed in addition to the universal conventions of (3-7).

[15] I believe the same effect could be obtained by means of the simpler rules below:

(xii) corresponding to (3-23a):

$$\# \rightarrow \emptyset \;/\; {}_{\bar{N}}[\_\_\_ \ldots]_{\bar{N}}$$

(xiii) corresponding to (3-23b):

$$\# \rightarrow \emptyset \;/\; {}_{X}[\ldots \_\_\_]_{X}, \text{ where } X = N, A, \text{ or } V.$$

However, note that these rules are not of the form indicated in (3-25).

[16] However, in the analysis of Igbo which has been proposed here, there are weak word boundaries between the associative ↓ and the elements to either side of it even in the proper noun possessive, where it does not undergo cliticization.

APPENDIX

THE NONTONAL PHONOLOGY OF IGBO

1. The Phonological Segments

Green and Igwe (1963), from whom most of the data in this work is taken, list the following distinct phonological segments for Ọ'h̃ụh̃ụ↓ Igbo:

Consonants

Plosives		Voiceless		Voiced	
		Aspirated	Unaspirated	Aspirated	Unaspirated
Bilabial	Simple Palatalized Velarized	ph' phy	p py kp*	bh bhy	b by gb*
Alveolar	Simple Palatalized	th (thy)ch	t (ty)c	dh (dhy)jh	d (dy)j
Velar	Simple Labialized	kh khw	k kw	gḥ gḥw	g gw
Fricatives					
Labio-dental	Simple	f	f̃	v	ṽ
Alveolar Alveolar	Simple Palatalized	s sy	s̃ s̃y	z zy	z̃ z̃y
Velar	Simple			gh	
Aspirate	Simple Palatalized Labialized			h hy	h̃ h̃y h̃w
Rolled	Simple Palatalized			r ry	r̃

* implosive

Nasals		
Bilabial	Simple	m
Alveolar	Simple Palatalized	n ny
Velar	Simple Labialized	ŋ ŋw
Lateral		
Alveolar		l
Semi-Vowels		
Palatal Velar		y w

The Vowels[2]

Front		Back		
[i]	([i])	([u])	[u]	1 Close
[ị]	([e])	([ω])	[ụ]	2
[e]	([ɛ])	([o])	[o]	1 Open
[a]	([a])	([ɔ])	[ọ]	2

Ladefoged gives almost the same list of distinctive phonological segments for the dialects spoken near Owerri; however, he includes the non-nasal [hw] (or [ʍ]) which appears as a gap in Green and Igwe's consonant chart, and does not list the nasalized continuants [ṽ], [z̃y], [h̃], [h̃y], [h̃w], and [r̃] as separate phonemes. The status of the nasalized consonants will be discussed below, in the section on nasalization. The nasalized and aspirated series of consonants are present only in the central dialects of Igbo, which therefore exhibit a far greater number of lexical contrasts than the outlying dialects.

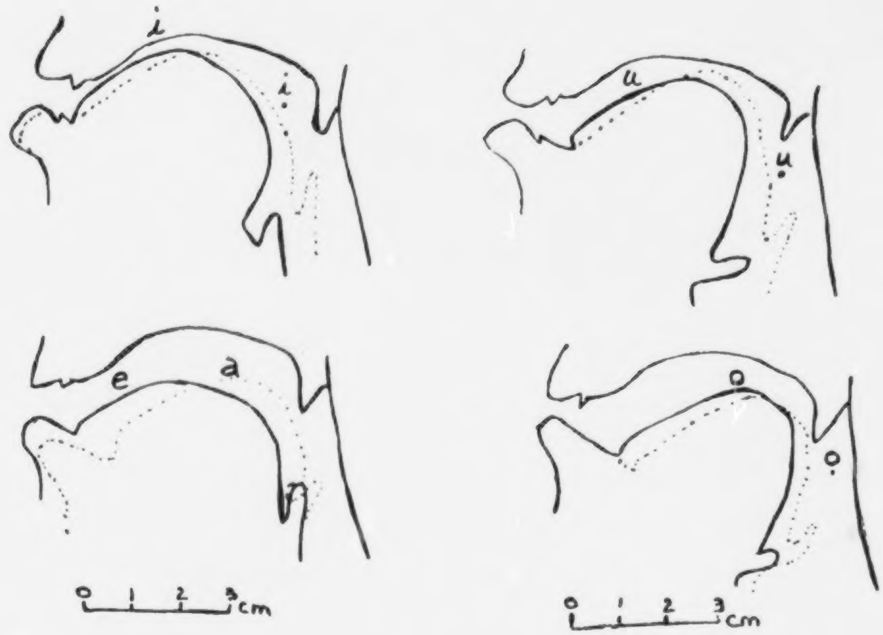
In this study, I have followed Green and Igwe's notation in all cases except the following: (i) I have used the synbol [ɣ] rather than [gh] for the voiced velar fricative, so as to avoid confusion with the aspirated stop which Green and Igwe symbolize as [gḥ]. (ii) I have written the segments which Green and Igwe write as [ny] and [ŋw] as [ỹ] and [w̃], respectively, thus making these segments part of the series of nasalized continuants. My reasons for making this change will be given in section 3 below.

Ladefoged (1968) made careful instrumental analyses of the Igbo "implosives" [kp] and [gb], and found that only the voiced member of this pair is a true implosive, with a downward thrust of the glottis. Unlike the [gb]'s of the Guang languages and of Yoruba, the [gb] of Igbo is not actually a co-articulated stop, for although the back of the tongue is considerably raised in the production of this sound, there is no actual closure the velum. Ladefoged thus transcribes this consonant as [ɓ] rather than as [gb].

In contrast to [gb], the Igbo [kp] is, Ladefoged found, a true co-articulated stop; however it is not an implosive but is made with a "velaric airstream mechanism of the kind that produces the clicks which are common in Zulu, Xhosa, and other South African languages... After the two closures have been made, there is a downward movement of the jaw and a backward movement of the point of contact of the back of the tongue with the soft palate; these movements cause a lowering of the pressure in the mouth... when both closures are released, the air flows into the mouth from two directions" (through the lips and from the lungs).

Ladefoged also discusses the stop consonants of Igbo, noting that from a phonetic point of view the distinction between voiced consonants, voiceless consonants, and voiceless aspirated consonants is a matter of the "time of onset of normal vocal cord vibration in relation to the formation, hold, and release of an articulatory closure." In contrast, the VOICED aspirated stops are created in quite a different way, by means of a special "breathy voice" mode of vibration of the vocal cords after the release of the closure. Thus, as in the case of [kp] and [gb], sound pairs like [ph] and [bh], which are minimally distinctive on the phonological level, differ phonetically in more than one parameter.

Turning to the vowels, Ladefoged shows that the significant difference between the two vowel series which Green and Igwe call "series 1" and "series 2" is to be found in the position of the tongue root. Thus the diagrams below (taken from Ladefoged (1968), p. 38) show that in every case the body of the tongue is more retracted for the series 2 vowel than for its series 1 counterpart:



(in reproducing this chart, I have substituted the official orthography symbols which Green and Igwe use for the IPA symbols used by Ladefoged.) Stewart (1967) proposes the feature [±Advanced Tongue Root] ([±ATR]) to distinguish vowel series like these from one another.

2. Vowel Harmony

The reader will recall that there is agreement among the vowels of a single morpheme of Igbo with respect to the feature [±ATR]; in other words, within a single morpheme, every vowel is taken either from the [+ATR] series ([i], [e], [u], and [o]) or from the [-ATR] series [ị], [a], [ụ], and [ọ]). Thus we find monomorphemic words such as *uwe* 'clothes' and *ụwa* 'fate', but not **ụwe* or **uwa*. In addition, certain verbal affixes undergo harmony with respect to this feature, taking their ATR value from the syllable to the left, in the case of a suffix, or from the syllable to the right, in the case of a prefix. The examples below show that a verb prefix or cliticizing pronoun takes its ATR value from the first verb radical:

(2-1)

a. Infinitive prefix	i̱ri 'to eat'	i̝la 'to leave'
b. Negative prefix	e̱riγi 'not to eat'	a̱laγị 'not to leave'
c. Cliticizing pronoun	o̱ riri 'he ate'	o̝ lara 'he left'

Suffixes of the harmonizing class take their ATR value from the preceding verb radical or suffix, as can be seen from the examples of (b) above, where the vowel of the negative suffix γ*i*/γ*ị* is [ị] when the preceding verb radical has a [-ATR] vowel, but [i] when it has a [+ATR] vowel. Verb radicals and some suffixes do not undergo harmony, as can be seen from the verb

(2-2) agafechabeγi 'have not yet passed by'

in which the verb radicals *ga* 'go', *fe* 'pass' and *cha* 'complete' and the non-harmonizing suffix *be* 'ever, yet' all retain their characteristic ATR values. Note that the harmonizing suffix γ*i*/γ*ị* in this example takes its ATR value from the preceding suffix (*be*) rather than from any of the verb radicals which make up the verb root.

While it is not my purpose here to propose a theory of harmony phenomena, it is worth pointing out that facts of this sort lend themselves nicely to a dynamic suprasegmental treatment like that which has been proposed here for tone. Thus, suppose that, rather than specifying some value of the feature [±ATR] for each vowel segment, we instead introduce the change-of-tongue-root-position markers $\underset{[+\mathrm{ATR}]}{\frown}$ and $\underset{[-\mathrm{ATR}]}{\frown}$, which appear at the boundaries of syllables and indicate an advance of the tongue root and a retraction of the tongue root, respectively. In this system, the fact that a particular morpheme is pronounced with an advanced or retracted tongue root would be indicated by means of a change-of-tongue-root-position marker at the beginning of the morpheme. For example, the verb root *la* 'leave' would be represented as

(2-3) $$_{\underset{[+V]}{\mathrm{ROOT}}}[\ \overset{\frown}{[-\mathrm{ATR}]}\quad \mathrm{l}\ \ \mathrm{E}\ ]_{\underset{[+V]}{\mathrm{ROOT}}}$$

and the verb root *ri* 'eat' as

(2-4) $${}_{\substack{\text{ROOT}\\ {[+\text{V}]}}}[\quad \overset{\frown}{[+\text{ATR}]}\quad \text{r I }]_{\substack{\text{ROOT}\\ {[+\text{V}]}}}$$

The [E] and [I] in these representations stand for the vowel pairs [e]∿[a] and [i]∿[ị] respectively; since tongue root position has now been given a suprasegmental representation, it is no longer a feature of individual vowel segments, and Igbo can be said to have only four vowels, which may be represented as [E], [I], [U], and [O].

Now consider what happens when two or more morphemes are joined together to form a verb. One possibility is that two consecutive morphemes within the verb will have opposite tongue-root-position markers, as in the verb *wela* 'go home'. This verb is represented as follows:

(2-5) $${}_{\text{V}}[\quad \overset{\frown}{[+\text{ATR}]}\ \text{wE}\ \overset{\frown}{[-\text{ATR}]}\ \text{lE }]_{\text{V}}$$

The $\overset{\frown}{[-\text{ATR}]}$ in this verb is interpreted phonetically as a change in the position of the tongue root, which is moved at this point from an advanced position to a retracted one. But suppose the preceding tongue-root-position marker had also been a $\overset{\frown}{[-\text{ATR}]}$. This situation occurs in the verb *tụbha* 'throw in', which, in this system, will be represented as

(2-6) $${}_{\text{V}}[\quad \overset{\frown}{[-\text{ATR}]}\ \text{tU}\ \overset{\frown}{[-\text{ATR}]}\ \text{bhE }]_{\text{V}}$$

Here the internal $\overset{\frown}{[-\text{ATR}]}$ will have no phonetic realization at all, for once the tongue root has been advanced or retracted in Igbo, it cannot be advanced or retracted any further. In other words, the representation above is equivalent to that below:

(2-7) $${}_{\text{V}}[\quad \overset{\frown}{[-\text{ATR}]}\ \text{tubhE }]_{\text{V}}$$

Finally, consider the behavior of "harmonizing" suffixes like the negative suffix γ*i*/γ*ị*. If this suffix is represented simply as γƗ, with no initial tongue-root-position marker, then verbs such as *laγị* and *riγi* will have the representation

(2-8) a. $[\quad \overset{\frown}{[+\text{ATR}]}\quad \text{rƗγƗ}]$

b. $[\quad \overset{\frown}{[-\text{ATR}]}\quad \text{lEγI}]$

Since there is no tongue-root-position marker at the beginning of the suffix γI, the tongue-root position of the preceding morpheme is maintained, thus accounting for the agreement of this suffix with the preceding morpheme.

While, as we have seen, the behavior of the harmonizing suffixes of Igbo can be accounted for in this system without recourse to a rule, the harmony of the verb prefixes and cliticizing pronouns with the first verb radical requires the addition of a rule. Thus, notice that if we assume the same unmarked status for harmonizing prefixal elements which we assumed above for harmonizing suffixal elements, then the verbs of (2-1a,b) will have the underlying representations shown below:

(2-9) a. ${}_V[\ \mathrm{I}\ \underset{[+\mathrm{ATR}]}{\frown}\ \mathrm{rI}\ ]_V$ ${}_V[\ \mathrm{I}\ \underset{[-\mathrm{ATR}]}{\frown}\ \mathrm{lE}\ ]_V$

b. ${}_V[\ \mathrm{E}\ \underset{[+\mathrm{ATR}]}{\frown}\ \mathrm{rI}\ \gamma\mathrm{I}]_V$ ${}_V[\ \mathrm{E}\ \underset{[-\mathrm{ATR}]}{\frown}\ \mathrm{lE}\ \mathrm{I}\ ]_V$

The correct surface representation for these verbs and for the verbs of (2-1c), which contain a cliticized subject pronoun, can be obtained by means of a rule of the form

(2-10) ${}_V[\ \ldots\ \underset{[+\mathrm{ATR}]}{\frown}$

s.d. 1 2

s.c. Copy 2 before 1.

<ins>Condition</ins>: 1 contains no change-of-tongue-root-position marker.

Note that this rule is of exactly the same form as the tone rule of Verb-Final-Tone-Marker Insertion.

3. Nasality[3]

In addition to the harmony which they exhibit with respect to position of tongue root, the central dialects of Igbo are also characterized by nasal harmony, so that, with the exceptions to be noted below, every segment of a mono-morphemic word agrees in nasality with the first consonant of the word. In other words, if the first consonant is nasal, as in *aỹããs̃ũ* 'evening', then every subsequent segment is nasal, and if it is non-nasal, as in *iwiriwi* 'dust', then every subsequent segment is non-nasal.

There are two exceptions to the statement that every segment of a mono-morphemic word agrees in nasality with the first consonant of the word. First, the initial syllabic segment of a word lies outside the sphere of its nasal prosody, as can be seen from the fact that the initial vowel of *aỹããsũ* is its only non-nasal segment. Similarly, if the initial syllabic segment of a word is a syllabic nasal, its nasality does not necessarily spread onto subsequent segments, as can be seen from examples like *mvọ* 'claw', *nsi* 'poison', and *nsogbu* 'trouble'. The fact that the nasality of the initial syllabic segment of a word is independent of that of the rest of the word probably stems from the fact that this initial segment was historically a prefix, though in most words of modern Igbo it is no longer identifiable as an independent morpheme.

The second exception to the statement that every segment of a morpheme agrees in nasality with the first consonant has to do with the stop consonants, both nasal and non-nasal. These consonants block the spread of nasality and, in turn, spread their nasality onto subsequent segments. For example, in the word *mĩrĩki* 'milk', the nasality of the initial [m] spreads only up to the stop consonant [k]; the [k] itself and the [i] which follows [k] are non-nasal. Similarly, in the word *erimẽrĩ* 'food', all segments up to the nasal stop [m] are non-nasal, and all segments following it are nasal.[4]

The facts of nasality in Igbo can be handled in much the same way as the facts of tongue-root position. First, let us assume a pair of suprasegmental nasality markers $\underset{[+\text{nasal}]}{\frown}$ and $\underset{[-\text{nasal}]}{\frown}$, the first of which signals the lowering of the velum, and the second a raising of the velum. Let us assume, furthermore, that a morpheme of Igbo typically has the underlying representation

$$(3\text{-}1)\qquad {}_{\text{MORPHEME}}[\ ([+\text{syll}])\ \underset{[\pm\text{nasal}]}{\frown}\ \ldots$$

In other words, every morpheme has a nasality marker after its initial vowel, or if there is no such vowel, at the beginning of the morpheme. Nasality, (or non-nasality), once initiated, persists until a new nasality marker is reached. Note that in making nasality suprasegmental, we eliminate the nasal∿nonnasal distinction among the segments themselves; thus, among the fricatives, we are left with only [v], [z], [zy], [ɣ], [h], [hy], [hw], [r], and [ry]. These segments are unmarked for nasality.

The nasality of the initial syllabic segment of a word is predictable from its consonant/vowel status: if this segment is a vowel, it is non-nasal, and if it is a consonant, it is nasal. Consequently, the nasality marker at the beginning of a word can be introduced by the following rule:

(3-2) $${}_{X}\Big[\Big[\begin{matrix}+\text{syll}\\ \langle+\text{cons}\rangle\end{matrix}\Big]$$

s.d 1

s.c. Insert the nasality marker $\widehat{[\langle+\text{nasal}\rangle]}$ before 1.

This rule inserts a $\widehat{[+\text{nasal}]}$ if the initial syllabic segment of the word is a consonant, but a $\widehat{[-\text{nasal}]}$ if it is a vowel.

Now consider the effect of a stop consonant on the flow of nasality to the right. This effect is easily accounted for in this system if we assume that every stop consonant has an associated nasality marker -- $\widehat{[+\text{nasal}]}$ in the case of the nasal stops [m], [n], and [ŋ], and $\widehat{[-\text{nasal}]}$ in the case of the non-nasal stops [p], [b], [gb], [kp], [t], [d], [c], [j], [k], and [g].[5] In this view, the words *mĩr̃ĩki* and *erimẽr̃ĩ* will be represented as

(3-3) a. $\begin{array}{c}\widehat{[+\text{nasal}]}\\ \widehat{[+\text{ATR}]}\end{array}$ BIrI $\widehat{[-\text{nasal}]}$ kI

b. $\begin{array}{c}\widehat{[-\text{nasal}]}\\ \widehat{[+\text{ATR}]}\end{array}$ E $\widehat{[-\text{nasal}]}$ rI $\widehat{[+\text{nasal}]}$ BErI

Notice that since we have made nasality suprasegmental, there is no longer any distinction on the segmental level between the stop consonants [b] and [m], [d] and [n], and [g] and [ŋ]. These sounds can therefore be treated as unit segments, and represented as [B], [D], and [G], respectively. The segments [B], [D], and [G] are, of course, unspecified for nasality.

We can account for the facts of nasal harmony within the verb by allowing certain affixal elements to remain unmarked for nasality. Suffixal elements of this type will simply carry on the nasality or non-nasality of the preceding element of the verb, as in the examples below, which contain the harmonizing suffixes wE, and IE, which indicate initiation of an action and time before the present, respectively:

(3-4) a. Unu asawala? 'Have you begun to wash?'

(from E + $\widehat{[+\text{nasal}]}$, $\widehat{[-\text{ATR}]}$ *sE*
(affirmative incompletive prefix) 'wash'

+ *wE* + IE)
(suffix) (suffix)

b. Unu eriwewe? 'Have you begun to eat?'

(from E + $\widehat{[-\text{nasal}]}$, $\widehat{[+\text{ATR}]}$ rI
(affirmative incompletive suffix) 'eat'

+ *wE* + IE)
(suffix) (suffix)

The representation of these verbs, showing the distribution of tongue root and nasality markers is given below:

(3-5) a. $\widehat{[-\text{nasal}]}$ E $\widehat{[+\text{nasal}]}$ sE wE IE
$\widehat{[-\text{ATR}]}$ $\widehat{[-\text{ATR}]}$

b. $\widehat{[-\text{nasal}]}$ E $\widehat{[-\text{nasal}]}$ rI wE IE
$\widehat{[+\text{ATR}]}$ $\widehat{[+\text{ATR}]}$

The internal nasality and tongue-root markers in these verbs are part of the lexical representations of the verb radicals *sa* and *ri*. The markers at the beginning of each verb are inserted by rules (2-10) and (3-2). Since the position of the tongue root and of the velum are adjusted only when there is a marker indicating such a change, the tongue-root position and nasality of the initial verb radical are maintained throughout the unmarked suffixes *wE* and IE. Notice that affixal elements which are unmarked for one of the suprasegmental features tone, nasality, or tongue-root position, are frequently also unmarked for the others. However, this is not universally the case. For example, verb radicals of the "high-toned" class are unmarked for tone, but are marked for nasality and tongue-root position. Similarly, according to Green and Igwe (1963), the "distributive" suffix *si* does not harmonize in nasality, but may harmonize in tongue-root position (individual speakers vary). Apparently, then, some speakers do not assign an ATR marker to this morpheme, though all speakers assign it the nasality marker $\underset{[-\text{nasal}]}{\frown}$. This morpheme is unmarked for tone by all speakers.

FOOTNOTES TO THE APPENDIX

[1] Aspirated, palatalized, and labialized consonants are treated here as unit phonemes, though as Ladefoged (1968) observes, the "decision to regard the members of a particular sequence of consonants as single phonemic units or as clusters is ... often arbitrary." See Carrell (1970) and Welmers (1976) for arguments that some of these consonants should be analyzed as consonant clusters.

[2] The vowel symbols employed by Green and Igwe are those of the official Igbo orthography. I have written the IPA symbol in parentheses next to each vowel.

[3] The data in this section is taken primarily from Swift et al. (1962), who give the most careful marking of nasality. However, the facts stated here are also confirmed by Green and Igwe (1963).

[4] The difference in distribution between nasal stops like [m], [n], and [ŋ] and nasal continuants like [s̃], [ṽ], and [r̃] provides evidence that the segments which are written *ny* *ŋw* in the official Igbo orthography are in fact not nasal stops (i.e. [ny] and [nw]) but nasalized continuants ([ỹ] and [w̃]). If these segments were nasal stops, then, like other nasal stops, they should occur freely inside words. However, in actuality these segments have the distribution of nasalized continuants; that is, they occur only morpheme-initially and following a nasal consonant. I have therefore written them as [ỹ] and [w̃] rather than as [ny] and [ŋw]. This analysis also accounts for another distributional peculiarity in Green and Igwe's data--namely, that *y* and *w* are never found inside a word following a nasal consonant. This distributional peculiarity disappears if *ny* and *ŋw* are analyzed as [ỹ] and [w̃], since these segments, which do appear word-internally following a nasal consonant, are the expected reflex of [y] and [w] in this environment.

[5] Note that since stops are always syllable-initial in Igbo, the nasality marker which precedes a stop necessarily occupies a syllable boundary.

BIBLIOGRAPHY

Anderson, Stephen R. 1974. *The Organization of Phonology.* New York: Academic Press.

Bing, Janet. 1976. The Infinitive Phrase in Persian: Arguments for the Lexicalist Hypothesis, unpublished paper. University of Massachusetts, Amherst.

Bresnan, Joan W. 1971. Sentence Stress and Syntactic Transformations, in *Language* 47:2.

______. 1976. On the Form and Functioning of Transformations, in *Linguistic Inquiry* 7:3-40.

Carrell, Patricia L. 1970. *A Transformational Grammar of Igbo.* Cambridge: Cambridge University Press.

Chomsky, Noam. 1965. *Aspects of the Theory of Syntax.* Cambridge: MIT Press.

______. 1970. Remarks on Nominalization, in R. Jacobs and P. Rosenbaum (eds.), *Readings in English Transformational Grammar.* Waltham, Massachusetts: Ginn.

______. 1973. Conditions on Transformations, in Stephen Anderson and Paul Kiparsky (eds.), *A Festschrift for Morris Halle.* New York: Holt, Rinehart and Winston.

Chomsky, Noam and Morris Halle. 1968. *The Sound Pattern of English.* New York: Harper and Row.

Clements, G.N. and Kevin C. Ford. 1977. On the Phonological Status of Downstep in Kikuyu, in George N. Clements (ed.), *Harvard Studies in Phonology* vol. 1. Department of Linguistics, Harvard University.

______. Forthcoming. Tone in Kikuyu.

Crystal, David. 1969. *Prosodic Systems and Intonation in English.* Cambridge: Cambridge University Press.

Dreher, J.J., et al. 1966. Instrumental Investigation of Single and Paired Mandarin Tonemes, in Douglas Advanced Research Laboratory, Huntington Beach, California.

Dwyer, D.W. 1978. What is a Suprasegmental Tone Language? To appear in *Studies in African Linguistics.*

Edmundson, T. and J.T. Bendor-Samuel (1966) Tone Patterns of Etung, *Journal of African Languages*, 5.

Edmonds, Joseph E. 1976. *A Transformational Approach to English Syntax: Root, Structure-Preserving, and Local Transformations.* New York: Academic Press.

Goldsmith, John. 1974. An Autosegmental Typology of Tone: and How Japanese Fits in, in E. Kaisse and J. Hankamer (eds.) *Papers from the Fifth Annual Meeting, Northeastern Linguistic Society.* Cambridge: Harvard Press.

_______. 1976. *Autosegmental Phonology.* Unpublished Doctoral Dissertation. MIT, Cambridge, Massachusetts. Distributed by Indiana University Linguistics Club. A revised edition is to be published by Garland Press, Inc.

_______. 1978. Complementizers and the Status of Root Sentences, in Mark Stein (ed.) *Proceedings of the Eighth Annual Meeting, Northeastern Linguistics Society.* Amherst: University of Massachusetts.

Goodluck, Helen. 1977. An Autosegmental Analysis of Slovene Pitch Accent, unpublished paper. University of Massachusetts, Amherst.

Green, M.M. and G.E. Igwe. 1963. *A Descriptive Grammar of Igbo,* Oxford University Press.

Hale, Ken, Jeanne LaVerne Masayasva and Paul Platero. 1977. Three Cases of Overgeneration, in Akmajian, Culicover and Wasow (eds.) *Formal Syntax.* New York: Academic Press.

Halle, M. and K.N. Stevens. 1971. A Note on Laryngeal Features, Quarterly Progress Report No. 101, Research Laboratory of Electronics, MIT, Cambridge, Massachusetts.

Haraguchi, Shosuki. 1975. *The Tone Pattern of Japanese: An Autosegmental Theory of Tonology.* Unpublished Doctoral Dissertation. MIT, Cambridge, Massachusetts.

Hattori, Shiro. 1973. What is the Prosodeme, i.e. 'Word Accent,' and What are Its Distinctive Features? *Science of Languages* 4:1-61.

Hyman, Larry M. 1975. *Phonology: Theory and Analysis.* New York: Holt, Rinehart and Winston.

Hyman, Larry M. and Russell G. Shuh. 1974. Universals of Tone Rules: Evidence from West Africa, in *Linguistic Inquiry* 5:81-115.

Igwe, G.E. and M.M. Green. 1967. *Igbo Language Course: Book I: Igbo Language Study.* Ibadan: Oxford University Press.

______. 1967. *Igbo Language Course, Book II: Igbo Dialogues and Stories.* Ibadan: Oxford University Press.

Igwe, G.E. and M.M. Green. 1970. *Igbo Language Course: Book III: Dialogues, Sayings, Translations.* Ibadan: Oxford University Press.

Jackendoff, R.S. 1977. *$\bar{X}$ Syntax: A Study of Phrase Structure.* Linguistic Inquiry Monograph 2. Cambridge: MIT Press.

Kahn, Daniel. 1976. *Syllable-Based Generalizations in English Phonology.* Unpublished Ph.D. dissertation, MIT. Distributed by the Indiana University Linguistics Club.

Kratochvíl Paul. 1968. *The Chinese Language Today.* London: Hutchinson University Library.

Ladefoged, Peter. 1968. *A Phonetic Study of West African Languages: An Auditory-Instrumental Survey.* Second Edition. Cambridge: Cambridge University Press.

Lapointe, Steven. 1977. A Lexical Reanalysis of the English Auxiliary System, unpublished paper. Linguistics Department, University of Massachusetts, Amherst.

Leben, William R. 1973. *Suprasegmental Phonology.* Unpublished Doctoral Dissertation. MIT, Cambridge, Massachusetts.

______. 1977. Studies in the Suprasegmental Representation of Tone, mimeographed paper. Stanford University.

Lehiste, Ilse. 1970. *Suprasegmentals.* Cambridge: MIT Press.

Liberman, Mark. 1975. *The Intonational System of English.* Unpublished Doctoral Dissertation, MIT, Cambridge. Distributed by Indiana University Linguistics Club.

Liberman, Mark and Alan Prince. 1977. On Stress and Linguistic Rhythm, in *Linguistic Inquiry* 8:249-336.

McCawley, James D. 1964. What is a Tone Language? Paper Presented at the summer meeting, Linguistic Society of America.

______. 1968. *The Phonological Component of a Grammar of Japanese.* The Hague: Mouton.

______. 1970a. Some Tonal Systems That Come Close to Being Pitch Accent Systems But Don't Quite Make It, in *Papers from the Sixth Regional Meeting.* Chicago: Chicago Linguistic Society.

______. 1970b. A Note on Tone in Tiv Conjugation, in *Studies in African Linguistics* 1:123-29.

Maran, L.R. 1971. Burmese and Jingpho: A Study of Tonal Linguistic Processes, in *Occasional Papers of the Wolfenden Society on Tibeto-Burman Linguistics*. Volume IV. Urbana: Publications of the Center for Asian Studies, University of Illinois.

Peters, S. and R.W. Ritchie. 1973. On the Generative Power of Transformational Grammars, in *Information Sciences* 6:49-83.

Pike, Kenneth L. 1948. *Tone Languages: A Technique for Determining the Number and Type of Pitch Contrasts in a Language, with Studies in Tonemic Substitution and Fusion.* Ann Arbor: The University of Michigan Press.

Schachter, Paul and Fe T. Otanes. 1972. *Tagalog Reference Grammar.* Berkeley: University of California Press.

Selkirk, Elisabeth O. 1972. *The Phrase Phonology of English and Frencn.* Unpublished Doctoral Dissertation. MIT, Cambridge.

______. 1974. French Liaison and the $\bar{X}$ Notation, in *Linguistic Inquiry* 5:573-90.

______. 1976. On Bracketing and Boundaries in Phonological Representation, paper delivered at the eighth Annual Conference of the Northeastern Linguistic Society, MIT, Cambridge, Massachusetts.

______. Forthcoming. *Phonology and Syntax: The Relation Between Sound and Structure.* Cambridge: MIT Press.

Stewart, John M. 1967. Tongue-root Position in Akan Vowel Harmony, in *Phonetica* 16:185-204.

______. 1971. Niger-Congo, Kwa, in T. Sebeok (ed.) *Current Trends in Linguistics* 7:179-212. The Hague: Mouton.

Voorhoeve, Jan. 1971. Tonology of the Bamileke Noun, in *Journal of African Languages* 10, part 2, pp. 44-53.

Voorhoeve, Jan, A.E. Meeusen and K.F. deBlois. 1969. New Proposals for the Description of Tone Sequences in the Igbo Completive Phrase, in *Journal of West African Languages* 6:79-84.

Wada, Minoru. 1958. Hukuzatsuna Accent Taikei no Kaishaku, (On the Analysis of a Complicated Accent System) in *Kokugogaku* 32:72-90.

Wang, William S.-Y. 1967. Phonological Features of Tone, in *International Journal of American Linguistics* 33:93-105.

Wang, William S.-Y. et al. 1967. Tone 3 in Pekinese, in *Journal of Speech and Hearing Research* 10:629-36.

Ward, Ida. 1936. *An Introduction to the Ibo Language*. Cambridge: W. Heffer and Sons.

Welmers, B.F. and W.E. Welmers. 1968a. *Igbo, A Learner's Dictionary*. Los Angeles: African Studies Center, University of California.

______. 1968b. *Igbo, A Learner's Manual*. Private Publication by the authors.

Welmers, W.E. 1970. The Derivation of Igbo Verb Bases, in *Studies in African Linguistics* 1:49-59.

______. 1976. *African Language Structures*. Berkeley: University of California Press.

Williams, Edwin S. 1974. *Rule Ordering in Syntax*. Unpublished Ph.D. Dissertation, MIT, Cambridge. Distributed by Indiana University Linguistics Club.

______. 1976. Underlying Tone in Margi and Igbo, in *Linguistic Inquiry* 7:463-84.

Winston, F.D.D. 1960. The 'Mid' Tone in Efik, in *African Language Studies* 1:185-92.

Woo, Nancy. 1969. *Prosody and Phonology*. Unpublished Doctoral Dissertation. MIT, Cambridge.

______. 1970. Tone in Northern Tepehuan, in *International Journal of American Linguistics* 36:20-30.